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Science

THE SCIENTISTS NEWSWEEKLY

The Roscoe B. Jackson Memorial Laboratory for Cancer Research burning early on the morning of October 24 as a bystander watches helplessly (see *Science*, October 31).

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Fourth International Cancer Research Congress

E. V. Cowdry

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Fourth International Cancer Research Congress:

St. Louis, September 2–7, 1947

E. V. Cowdry, *President*[1]

PRESIDENT TRUMAN, IN HIS OPENING message to the Congress, said:

This meeting has large significance to the United States and to the world at large from every point of view—social, economic, political, and spiritual. No further argument is needed to support such a statement than the fact that in the United States alone 180,000 persons die annually of cancer. The last war showed more clearly than ever before the value of coordinated research. How fruitful, therefore, will be this assembly from the whole world of scholars interested in the solution of the cancer problem.

In a later telegram the President advised the Congress as follows:

It is now possible for the United States to take an important forward step toward greater international cooperation in the field of medical and biological research. On behalf of the people of the United States I am pleased to announce to the Fourth International Cancer Research Congress that progress in the production of radioisotopes by the United States Atomic Energy Commission now permits limited distribution to qualified research workers in other countries of radioisotopes principally for medical and biological research. I know that the representatives of the United States attending the cancer research congress share my hope that the open, impartial and truly international character of medical research will carry over into the realm of other problems of world concern. The sharing by and among all nations of both the means and the results of cancer research will reduce the loss of life and human suffering from disease throughout the world.

Thus, the Cancer Research Congress commenced very auspiciously. The suggestion by the President of the United States, that the members were pioneers in international cooperation and that success by them in the field of cancer research might lead the way to international teamwork in other matters, was stimulating. The announcement by him that henceforth all nations can share in the opportunities for investigation provided by radioactive isotopes was a long step in the right direction. Indeed, it answered a question uppermost in their minds.

The attendance from abroad was larger than we had dared expect at a time when travel was difficult and the whole world was busy trying to recover from the last war. The fact that this attendance amounted to 139 is due to help received from many sources.

The chairman of the Governmental Liaison Committee, L. A. Scheele, worked long, faithfully, and wisely in Washington. We have him to thank especially for the effective cooperation of the U. S. Department of State. Had it not been for the courtesy of the Department in transmitting invitations to all nations of the world, except Japan, Germany, and Spain, the attendance of official delegates from abroad would have been nil.

Early realization of the fact that, in addition to these official delegates, many other leaders in cancer research would like to attend the Congress, but could not because of financial obstacles, led to prompt action. S. Bayne-Jones, chairman of the Finance Committee, raised money not only for routine expenses of the Congress but also, in many instances, for travel. The most substantial donors were: the American Cancer Society and its agent, the Growth Committee of the National Research Council, the U. S. Public Health Service through the National Advisory Cancer Council, the Jane Coffin Childs Memorial Fund, Eli Lilly & Company, the Anna Fuller Fund, and Barnard Free Skin & Cancer Hospital.

The Danforth and Donner Foundations made no payments directly to the Congress but did financially assist representatives from abroad to attend. Mr. Edwin S. Jones of the First National in St. Louis, served as treasurer of the Congress.

Represented at the Congress were: Argentina, Australia, Belgium, Bolivia, Brazil, Canada, Chile, China, Colombia, Czechoslovakia, Denmark, Egypt, El Salvador, France, Great Britain, Greece, India, Iran, Iraq, Italy, Korea, Luxembourg, Mexico, Netherlands, Nicaragua, Norway, Palestine, Panama, Peru, Philippines, Portugal, Siam, Sweden, Switzerland, Tunisia, Turkey, Union of South Africa, United States, Uruguay, and Venezuela.

Representatives from Austria, Cuba, Ecuador, Paraguay, Java, Hungary, and Russia, though named and expected, did not attend. Ethiopia, Lebanon, Dominican Republic, Eire, Finland, Saudi Arabia and Yemen, Afghanistan, Liberia, Costa Rica, Honduras, Poland, New Zealand, and Bulgaria indicated active interest in international cooperation in cancer research.

This means that 60 nations answered the call issued through the State Department. The U. S. attendance was excellent, making a total registered membership of 816.

Unification was provided by holding all the meetings on the first and second floors of one hotel, The Jefferson. In this way many people, often talking different languages but having the common ambition of discovering new facts about cancer, helped each other in ways too numerous to mention. The meetings did not drag and become monoto-

[1] Professor of Anatomy, Washington University, and Director of Research, Barnard Free Skin & Cancer Hospital, St. Louis.

nous because there was so much from which to choose. Shields Warren, chairman of the Program Committee, ably seconded by the vice-chairman, Sidney Farber, supplied a program of great variety. A general session of comprehensive and fairly long papers and five smaller special sessions of shorter reports on cancer were in simultaneous operation. Also attracting many was a splendid series of exhibits arranged by G. W. Larimore, chairman of exhibits. These demonstrations of new techniques, methods, and results were of great help to those planning their own experiments, and the showings of well-chosen motion pictures, also provided by Dr. Larimore, gave inspiration and relaxation. Important also were the informal discussions on easy chairs in the corridors situated close to both the exhibits and the scientific meetings.

The atmosphere of friendly give and take was carried into the late afternoons and evenings by the enterprise and devoted service of the Local Arrangements Committee, under A. N. Arneson and Lt. Col. E. C. Sibley, which operated in five subcommittees: *Delegates and Foreign Investigators:* chairman, James F. Nolan; *Foreign Consulates:* chairman, Alphonse McMahon; *Women's Entertainment:* chairman, Mrs. Wendell G. Scott, and co-chairman, Mrs. Frank R. Bradley; *Entertainment:* chairman, Wendell G. Scott; *Local Transportation:* chairman, Col. A. M. Libasci.

In addition, there was a large Reception Committee of 38 St. Louis doctors. Much entertainment in private homes gave evidence of hospitality. The bringing together of large groups in the evenings was accomplished by three dinners in the hotel, a fine supper given by St. Louis University, and a special performance of the Little Symphony, offered by Washington University.

Those attending will not be surprised that it took almost exactly a year to make preparations for the Congress. First, W. U. Gardner, president of the American Association for Cancer Research, consulted the National Research Council and received the permission of the U. S. Department of State. He then invited the Union International Contre le Cancer, through its president, Justin Godart, to join the Association in sponsoring the Congress. All winter and spring the organization of the Congress was developed by these Committees: *Local Arrangements:* chairman, A. N. Arneson, and vice-chairman, Lt. Col. E. C. Sibley; *Finance:* chairman, S. Bayne-Jones; *Exhibits:* chairman, G. W. Larimore; *Governmental Liaison:* chairman, L. H. Scheele; *Publicity:* chairman, M. G. Seelig; *Program:* chairman, Shields Warren, and vice-chairman, Sidney Farber.

From August 4 to September 27 Frank McGurk, loaned to us by the National American Red Cross, served most effectively as full-time secretary general. It would have been greatly to the advantage of the Congress if he could have come earlier and stayed longer.

It will be asked what precisely were the objectives of the Congress beyond meeting old friends, making new ones, and the resulting cross-fertilization of ideas. There were two purposes: first, to review the recent advances that have been made in cancer on a world-wide front, and, second, to lay the basis for international cooperation so that research can be carried on more effectively. With the encouragement of the President of the United States, it was felt more keenly than before that the eyes of the thinking world were on this international gathering. Because of this fact, the action of the American Cancer Society in delegating a member of its staff, Pat McGrady, a skilled publicity man, to cooperate with Dr. Seelig, publicity chairman, was especially opportune. The press worked loyally under Mr. McGrady. The greatest care was necessary to give the facts without conveying unwarranted hope of the effectiveness of the new and possibly improved methods of treatment reported, because no one knew better than Dr. Seelig how tragically cancer sufferers grasp at straws.

This review of recent advances and up-to-date techniques was timely. The world is in a period of reconstruction. Universities, cancer hospitals, and clinics in some countries have been completely wrecked, while in others work has been carried on with skeleton staffs sadly restricted by lack of equipment and supplies. It is essential that the new buildings to be erected be well planned, that the investigators work with full knowledge of what already has been done, that they have the most effective equipment and adequate supplies of materials such as the radioactive isotopes liberated by President Truman. In other words, to have organized cancer research poorly armed and informed would have been a terrible handicap, especially since it is so difficult, having embarked on a program, to change it or abandon it and start all over again. Our plan is to make the transactions of the Congress available to all by publication in *Acta* under the editorship of J. Maisin, of the University of Louvain in Belgium, but it is now evident that the balance in the treasury of the Congress will be altogether insufficient for this purpose and additional money will have to be secured.

Even briefly to review the results of hundreds of reports to the Congress is not feasible here. Abstracts of many of them are contained in the printed program, itself a volume of 168 pages. Cancer being a condition that can be manifested by a wide variety of cells of the body from before birth to the point of death in more or less remote response to the action of hundreds of influences not only in man but in thousands of animal species, the ground covered by it is greater than by any other disease. No two individuals would give the same appraisal of the advances reported. We are frequently asked, "Well! What really new was reported for the first time at the Congress?" The questioner knows that he may get cancer himself, or he may already have it, and he definitely has in mind prevention, diagnosis, and treatment.

With respect to prevention, cancer hazards are par-

larly great in certain industries, and detailed recommendations were made for protection. Individual disposition to cancer was stressed in several papers. e progress was reported in recognition of the kind of vidual most likely to get cancer and of the properties precancerous conditions that serve as alarm signals. owledge of the causes of cancer is to some extent help- in prevention, and much was said about cancer duction. Viruses were considered in detail, but no dence was given that human cancer is infectious. The ure and operation of the so-called milk factor was idated.

The importance of discovering some chemical or micro- logical test by which cancer can be detected wherever xists in the body and earlier than by the methods now use is universally admitted. Tests based on the ex- ination of the blood and urine of patients suspected cancer were reported. Further work alone will show ir value. The well-known technique of examination of ginal smears in the diagnosis of uterine cancer was cussed and its wider use indicated. Success in the gnosis of some lung cancers by examination of cells the sputum was described. Reports on transplantation hnique seemed to strengthen its diagnostic value. Improvements in treatment of cancer are, of course, st urgently needed. Present hope rests chiefly on early gical excision of cancer before it has spread through body. Distinguished radiologists and surgeons re- ewed technical procedures and results and outlined ture possibilities. Since the logical basis for experiments ding to the discovery of new and different methods of eatment is knowledge of how cancer cells differ from the rmal cells from which they spring, these properties re investigated by a host of techniques, and encourag- g progress was reported. Many and sometimes favorable tempts to inhibit cancer growth by hormone adminis- tions were discussed. The beneficial effect of tissue tracts on some cancers was claimed. Numerous papers chemotherapy showed beyond question the value of tegrated research on a fairly large scale and the ad- sability of testing substances wholesale on the chance at some of them may prove effective. Preparations lled KR and ACS from Russia, FA from Italy, and 11 from England were exhaustively investigated, but claim was made that they are the answer to the great estion of how to cure advanced cancer. Reports on the w pain-killing drugs, metopon and amidone, were well ceived.

The Congress showed that chemical and physical chniques are being brought to bear on cancer as never fore. We are in a far more advantageous position than the last Congress in Atlantic City in 1939. Inci- ntally, the second and first Congresses were held in russels in 1936 and in Madrid in 1933, likewise under e Union Internationale Contre le Cancer. At this, the ourth Congress, the importance of the electron micro- scope, of polarization optical methods, of ultracentrifugation, and of other techniques was manifest, and the new betatron was described. Most significant, perhaps, were the papers and exhibits on radioactive isotopes which served to orient investigators planning to use them in their own researches.

Some, however, had the sobering thought that after the Congress would come a flood of letters from cancer sufferers, told that their cases were hopeless, pleading for information about new cures reported at the Congress, and that each and every one of these inquiries probably would have to be answered by saying that there is still no cure for advanced cancer and that they should trust their physicians.

Yet a feeling of optimism pervaded the meetings. One great scientist marveled at the mass of facts already known about cancer. He remarked that the scientific sessions in some of the rooms were quite beyond him and truly stated that no single human being is capable of an intelligent appreciation of this enormous mass of knowledge. He mentioned the idea that someone gifted with the power of putting two and two together might propose a real cure; that is to say, if we look back some 20 years hence, we may wonder at our dumbness. But he was quick to call for more experiments.

When questioned, some said that atomic energy had been harnessed and that it was only a question of time before advanced cancer, now considered hopeless, would be cured. But these were reminded that it may well be more difficult to solve the cancer problem than to find out how to make an atomic bomb. Others were impressed by the fact that cancer sometimes grows quickly, sometimes slowly, and in extremely rare cases disappears without treatment. They thought that an understanding of the reasons for these phenomena would light the way to purposeful control.

The majority were simply encouraged by the teamwork being developed in cancer research. The old guerrilla warfare against cancer is being replaced by organized research. Yet it was admitted that a good beginning has hardly been made. No actual poll was taken but, rather careful estimates indicated that, of those presenting the results of researches at the Congress, the vast majority were working on cancer only in the time that they could spare in competition with other duties. As long as the offensive against cancer is so predominately a spare-time occupation it will be a half-hearted affair.

Another serious handicap, the magnitude of which was brought out by sample questioning, is that few indeed of the investigators have enough financial backing to feel able to carry on for as long as five years; most of them could count on support for only one year. With such insecurity, the peace of mind necessary for productive research is sadly lacking, and there is a tendency to concentrate on get-the-results-quickly projects, neglecting important long-term ones.

All at the Congress were in favor of international cooperation, though some questioned its feasibility. To lay a satisfactory basis for this in less than a week called for careful thought and prompt action.

Obviously, the 139 representatives from abroad together with the 8 official U. S. delegates constituted a group too large to make much progress, but it was evident that their advice was valuable and should be followed in this, the supremely important task of the Congress, emphasized indeed in the President's message.

These national representatives therefore held an organization meeting on September 2. After free discussion it was decided to assign the duty of making specific recommendations to a smaller group consisting of but one representative of each nation, who would receive counsel and advice from his compatriots. This group, designated the Executive Committee of National Representatives, held meetings on September 3, 4, and 5. In order to spread the responsibility internationally, a representative of the United States, Great Britain, and Mexico acted as chairman, respectively, on these dates. The recommendations prepared were presented on September 6 in English, French, and Spanish to the larger body of National Representatives for approval.

The essential feature of these recommendations was the establishment of a small but representative *International Cancer Research Commission.* It was proposed that the Commission consist of but one member from each of the nations at the Congress and that these have equal voting power, quite irrespective of the size of the nation represented. In order regularly to draw new personnel into the Commission, it was proposed that no member shall serve for more than three years. To decentralize the Commission, it was proposed that the annual meetings never be held consecutively in the same country.

Since the need was felt to build within the framework of an existing international organization in the field of cancer, it was proposed that the Commission be constituted as an almost autonomous division of the Union Internationale Contre le Cancer. Fortunately, members of the Executive Committee of the Union were present at the Congress and formally accepted the Commission on this basis, which was specified in detail. It is expected that the Union will be closely related to the World Health Organization. It was agreed that cancer research is to be interpreted to include all efforts to advance our knowledge of cancer by clinical, experimental, or other means.

It was recommended that single representatives of still other nations be welcome in this Commission, and that a five-member Executive Committee of the Commission be appointed and later be expanded to not more than seven members. To make this Committee representative, it was proposed that it consist of one member from Latin America, one from Asia, one from the United States, and two from Europe, supplemented by alternates to serve in case any of the members was unable to do so. The actual membership suggested was:

I. Millan (Mexico), chairman; alternate, F. Lebo (Uruguay)

E. V. Cowdry (United States); alternate, W. U. Gar (United States)

V. R. Khanolkar (India); alternate, Tu-Shan Yung (Ch

J. H. Maisin (Belgium); alternate, A. Lacassagne (Fra

A. Haddow (England); alternate, J. Engelbreth-H (Denmark)

It was understood that Haddow would represent whole British Empire.

These recommendations, finally presented to the en Congress on September 6, were enthusiastically and un imously approved. Consequently, the single represe tives from each of the 40 nations at the Congr constituting the charter members of the Internatio Cancer Research Commission, consider that they hav mandate from the Fourth International Cancer Resea Congress to proceed along these lines. It is their hope, a we believe that of mankind everywhere, that this Co mission soon will be expanded to include the remain of the 60 nations which responded so cordially to the vitation transmitted by the U. S. Department of Sta but were unable actually to take part in the Congr In addition, and as quickly as possible, the coopera on the same basis of Japan, Germany, and Spain is gently needed.

The appointment of new members from these ot entering nations as well as replacement of charter me bers upon their retirement in three years will invigor the Commission. It was clear, however, that if majority are replaced after three years by newcom unfamiliar with the work of the Commission, orde development and continuity of work will be in jeopar For this reason it was decided to suggest to the nati involved that the replacing members attend the l annual meeting of these retiring charter members experience, but without power to vote.

Not the least benefit derived from the Internatio Cancer Research Commission will flow from the act choosing members as national representatives in an creasing number of countries all over the world. Ever where it will honor the individual, dignify cancer researc and strengthen public support for such research. T feeling was repeatedly voiced that the person chos should be representative of the leading cancer resear organization in each country, and it is not unlikely th this will be a factor in the creation of such organizatio in nations not already so equipped.

Dr. Millan and his Executive Committee have t immediate responsibility of consolidating the Comm sion and of securing the financial life blood without whi it cannot function. Wise publicity is called for. They w also make a detailed study of objectives and methods operation and submit this at the next annual meeting

Commission in 1948 at a time and place soon to be unced. However, it can be said at once that the mission does not seek in any fashion to control cancer rch anywhere. That would be unwarranted in- on. Rather, I believe it to be the intention of the ter members of the Commission to give advice and financial assistance when requested and to promote eration in cancer research between the nations that come it.

o nation, large or small, has a monopoly of wisdom. can participate in the world problem of discovering effective means to prevent, diagnose, and cure er. Progress in cancer research springs from quality, quantity. The research front in cancer is so extensive many small but promising research projects costing little can be selected as well as large ones. Both are anded and the sooner the better, for there is urgency. re is also something to be said in favor of holding the ual meetings of the International Cancer Research mission not where there are comparatively large ups of active investigators but in other countries ch thereby may be encouraged more vigorously to anize their resources against cancer. We have great ectations that national frontiers will give way in the ling of such resources. The vision includes some ghboring countries, unable financially alone to es- lish and maintain the well-equipped cancer research institutes required for certain lines of inquiry, joining forces for the common good.

Looking back to the feverishly active days of the Congress, it is clear that the *International Cancer Research Commission* developed smoothly because it was something everybody earnestly wanted and because the wisdom of the policy of decentralization, adopted at the very beginning, was self-evident. This policy found expression in equal representation by all nations, in the headquarters of the Commission being temporary and dependent upon the location of the chairman of the Executive Committee of the Commission, and in the decision never to hold annual meetings of the Commission consecutively in the same country. It is safe to say that the charter members of the Commission share with President Truman the hope that international cooperation thus made effective will spread to other problems of world concern.

The 139 representatives of 40 nations returning home from the Fourth International Cancer Research Congress are ambassadors of good will and of hope for all nations. They look forward with pleasure to the Fifth Cancer Congress. No decision was reached as to where this will be held; but, as a decentralization measure, it will certainly not be in the United States. Recommendations as to location will be made to the Union Internationale Contre le Cancer by the International Commission.

Obituary

S. F. Light

1886–1947

The tragic death by drowning of Prof. S. F. Light on ne 21, 1947, represents a severe loss to biology. Prof. ght had for 22 years been a member of the Department Zoology at the University of California, Berkeley.

S. F. Light was born into a Presbyterian minister's mily in Elm Mills, Kansas. After graduation from Park llege, Missouri, in 1908, he spent two years teaching in vernment schools in Japan, two in the Manila High hool, Philippine Islands, and two as instructor in Zool- y at the University of the Philippines, taking a Mas- r's degree from that institution in 1913. Except for one ar (1914–15) at Princeton University as Procter Fellow, s service at the University of the Philippines as assist- t, associate, full professor, and department head was ntinuous until 1922. From 1922 through 1924 he served professor and chairman of the Department of Zoology the newly organized University of Amoy, China. During these years he published a series of careful systematic studies on Philippine coelenterates, especially alcyonarians and scyphozoans, and on oriental termites. Some of these grew out of expeditions of which one, to Puerto Galero, Mindoro, in 1912, is of special interest, because this site has since been chosen, largely by his students, for the marine station of the University of the Philippines. From Amoy, in addition to material for later termite studies, came accounts of the astonishing amphioxus fisheries of that region. A great body of less tangible results of his contact with tropical faunas enriched his teaching and thinking in later years.

In 1924 Light returned to the States, intending to work for the doctorate and return to the Orient. His work on termites attracted the attention of the late C. A. Kofoid, who persuaded him to remain at the University of California after taking the Ph.D. in 1926 on termite flagellates. At this time his interest in biological aspects as distinct from the purely taxonomic first made its appearance in published work. Besides describing several new

genera and species of mastigote protozoa, he actively investigated the specificity of the intestinal faunas of various termite species, both descriptively and experimentally, studying natural and experimental defaunation, refaunation, and transfaunation. He was able to explain the previously reported mitotic flares in the termite gut as normal refaunation after molting, not realizing how close he was to the amazing relations between host molt cycle and protozoan reproductive cycle, recently discovered by Cleveland in roaches.

Much needed systematic work on termites was resumed and protozoa abandoned, however, in 1928, partly due to the large share of responsibility he assumed for the extensive cooperative investigation into all aspects of pure and applied termite biology which culminated in the volume *Termites and termite control* in 1934. During these years he became an international authority on the group, studying in particular the species of the western United States and Mexico, the South Pacific, and the Orient. This phase gave way about 1935 to the one which continued until his death—the analytical and experimental pursuit of problems of social physiology. During the course of a study involving staggering numbers of laboratory colonies of controlled composition, a large proportion of which remains to be published, the unimportance of genetic factors and the large role and much of the mechanism of caste determination by interaction in the social complex have been documented. The discovery of parthenogenesis in termites was one of several incidental results.

As an outgrowth of his teaching and special interest in the ecologic distribution of invertebrates, a program of analysis of the occurrence of species of the important fresh-water copepod genus *Diaptomus* was begun about 1934. First to be accomplished was a necessary systematic revision by which a large and cumbersome genus was satisfactorily divided into many subgenera, using new characters demanding high microscopic magnification. Toward an eventual attempt to explain the distribution, a large and carefully documented collection of western entomostracans was assembled during several years of intensive field work. The great values of such a coll tion will doubtless be realized in the work of oth to come.

Light exercised in his teaching a peculiarly pervas and long-lasting influence on his students' points of vie interests, and habits of thought. An outstanding char teristic of the introductory course in zoology which taught for many years was the painstaking guidance teaching assistants in pedagogical technic and basic bi logical concepts. His advanced courses, undoubte unique in modern invertebrate zoology, were mark respectively, by a critical, appreciative phylogene morphology and a critical natural history which insist on a full realization of the values of sound systemati keen field observation, and concrete, testable interpre tion. The essence of the natural history course is to found between the lines of its remarkable syllabus wh combines a dynamic field approach to basic ecolo problems and practical aids to the mastery of a speci fauna. One of its peculiar values is the obvious flux evolution, of which it represents but a stage. Its auth always apologetically spoke of it as a highly tentati step toward a very important goal.

Prof. Light played his role in biology and academic l in personal contacts rather than in national or universi organs. He profoundly affected the directions and at tudes of many graduate students and exerted a mark and constructive influence in departmental affairs. H intimates will remember the personal qualities of modes —extending to a real underestimation of self and as re an appreciation of disciplines which he regarded as b yond his ken (viz., optics, biochemistry), of exacti criticism in the use of words and ideas—driving him n to caution, now to very forward positions, of since interest in the human relations of all his assistants a students and of a highly developed aesthetic enjoyme of outdoor beauty. Many will feel that, although th never really knew the inner man, they learned vivid the goals and standards for which he lived.

T. H. Bullock

University of California, Los Angeles

NEWS *and Notes*

Lee A. DuBridge, president, California Institute of Technology, **E. O. Lawrence,** University of California, and **O. M. Solandt,** National Defense Board, received honorary D. Sc. degrees from the University of British Columbia at its 21st Fall Congregation, October 29. Dr. DuBridge delivered a lecture on "Science, the Basis of Industry" and also participated in a nuclear physics symposium at which he presented a paper, "The Atomic Age Isn't Yet Here."

Robert E. Marshak, associate professor of physics, University of Rochester, is now in Paris, where he will attend an international meeting of nuclear physicists, the first such gathering since World War II, to discuss nuclear physics and its social implications. The Paris conference, sponsored by the French Government, UNESCO, and various French scientific organizations, will also commemorate the 10th anniversary of the death of Lord Rutherford, distinguished British nuclear physicist. Dr. Marshak, chairman of the Federation of American Scientists, will represent that group at the conference.

F. R. Eirich, research associate, Department of Colloid Science, Cambridge University, England, has been appointed assistant professor of colloid chemistry, Polytechnic Institute of Brooklyn. During the war, Dr. Eirich won recognition from the British Government for his research on explosives.

Paul R. Cannon, professor and chairman, Department of Pathology, University of Chicago, will deliver the Third Richard H. Jaffé Memorial Lecture of the Institute of Medicine of Chicago, November 28, at the Palmer House, on the topic, "Tissue Synthesis as a Problem in Pathology."

Harry Seneca, research associate, College of Physicians and Surgeons, Columbia University, and consultant to Schering Corporation, recently flew by special plane to Cairo to assist in the control of the cholera epidemic and to study the methods employed in the treatment of the disease. He is cooperating in this study with the Division of Clinical Research of Schering Corporation.

William G. Pollard, formerly professor of physics, University of Tennessee, has been appointed executive director, Institute of Nuclear Studies, Oak Ridge. Dr. Pollard has been acting director of the Institute since February.

Visitors to U. S.

A. T. Knoppers, pharmacologist, Cinchona-Instituut, Amsterdam, Holland, arrived in New York November 17 for a tour of medical schools in this country and also to attend scientific meetings. He can be addressed in care of the Cinchona Products Institute, Inc., 10 Rockefeller Plaza, New York 20, New York.

A. K. Longair, of the Department of Scientific and Industrial Research, is expected to arrive in this country at the end of this month to take up his duties as assistant director of the United Kingdom Scientific Mission, Washington, D. C.

Grants and Awards

Cledo Brunetti, chief, Engineering Electronics Section, National Bureau of Standards, has received the award for engineering achievements given annually by the magazine *Materials and Methods*. Dr. Brunetti was honored for his wartime development of "printed" electronics circuits, which opened the way to the Army and Navy VT proximity fuse.

Glenn T. Seaborg, professor of chemistry, University of California, and co-discoverer of plutonium, will be awarded the 1948 William H. Nichols Medal of the New York Section, American Chemical Society, at a joint meeting of the Society's New York Section and the American Section of the Society of Chemical Industry, to be held March 5 at Hotel Pennsylvania, New York. The Nichols Medal, conferred annually to stimulate original research in chemistry and considered one of the highest honors in chemical science, was founded by the late William H. Nichols, a charter member of the American Chemical Society, and chairman of the board, Allied Chemical and Dye Corporation. It will be presented to Prof. Seaborg for his research on plutonium, and his participation in the discovery of americium and curium, and numerous artificial radioactive materials.

The Department of Physics, Case Institute of Technology, has received grants totaling $11,000 from the Research Corporation of New York. A grant of $6,000 will be used to complete the construction and the auxiliary equipment of the betatron which will be finished this year. The betatron was designed and supervised by **Earle C. Gregg, Jr.,** Department of Physics. A grant of $5,000 is intended for the development of new instruments and techniques to be used in connection with the betatron, a project which will be under the direction of **Erwin F. Shrader,** associate professor of physics, whose researches will be aimed at making the most effective use of the betatron, particularly in the development of electron multiplier tubes. These grants from the Research Corporation supplement a grant of $7,000 given last year for the betatron project.

Fellowships

Gilbert H. Fletcher, formerly resident and instructor in radiology, New York Hospital and Cornell Medical School, and roentgenologist, U. S. Army, during the war, has been appointed Traveling Fellow in the Department of Radiology, University of Texas, M. D. Anderson Hospital for Cancer Research. Dr. Fletcher is now making a study of European institutions which are devoted primarily to radiological investigation and treatment. During his tour, he will obtain data on the use of X-ray, radium, and other radioactive materials in the treatment of cancer in European countries and will visit the Radiumheminet of Stockholm, the Royal Free Cancer Hospital, London, the Institute of Radium, Curie Foundation, Paris, and many other institutions. The creation of a traveling fellowship establishes a precedent at the M. D. Anderson Hospital and at the Texas Medical Center. An exchange plan is being developed whereby students of cancer from all parts of the world may come to the Hospital for brief courses of training and consultation, and, in return, Hospital personnel may visit the outstanding institutions abroad.

Fifteen young investigators in the medical sciences were awarded travel fellowships to attend the International Physiological Congress held last summer at Oxford. Funds for five of these awards came from the income of the Trust Fund for the International Physiological Congress, of which the American Physiological Society is custodian. Ten additional fellowships were made possible by a Rockefeller Foundation grant. The 15 men so honored were: S. B. Barker, associate professor of physiology, University of Iowa; Alfred F. Bliss, assistant professor of physiology, Tufts College Medical School; Paul D. Boyer, assistant professor of biochemistry, University of Minnesota; William H. Fishman, research associate in biochemistry, University of Chicago; Robert G. Grenell, instructor of neuroanatomy, Yale University; Morton I. Grossman, assistant professor of physiology, University of Illinois; Carl G. Heller, associate professor of physiology, University of Oregon; Robert Hodes, associate in biophysics, The Eldridge Reeves Johnson Foundation for Medical Physics, University of Pennsylvania; William G. Kubicek, assistant professor of physiology, University of Minnesota; Gordon K. Moe, associate professor of pharmacology, University of Michigan; R. R. Overman, assistant professor of physiology, University of Tennessee; John R. Pappenheimer, associate in physiology, Harvard Medical School; Walter Franklyn Riker, Jr., instructor in pharmacology, Cornell University Medical College; James V. Warren, assistant professor of medicine, Yale University; and Earl Wood, assistant professor of physiology, Mayo Foundation, University of Minnesota.

Colleges and Universities

Harvard University has appointed a Faculty Committee to plan peacetime jobs for Harvard's most complex calculating machine which is still under contract to the Navy, but which works on peacetime computations during a part of every day. The membership, which will assure that problems of all fields will be considered, consists of Paul H. Buck, provost (chairman); Edward Reynolds, administrative vice-president; Gordon M. Fair, dean of engineering; James S. Simmons, dean, School of Public Health; Howard H. Aiken, professor of applied mathematics and director of the Computation Laboratory; Garrett Birkhoff, professor of mathematics; Howard W. Emmons, associate professor of engineering science; Wassily W. Leontief, professor of economics; Donald H. Menzel, professor of astrophysics; Julian S. Schwinger, professor of physics; and Samuel A. Stouffer, professor of sociology and director, Laboratory of Social Relations.

The University of California, Division of Entomology and Parasitology, has recently appointed the following men to its faculty: **Merlin W. Allen,** assistant professor of entomology and assistant nematologist, Experiment Station; **Deane P. Furman,** assistant professor of parasitology and assistant parasitologist, Experiment Station; **James R. Douglas,** assistant professor of parasitology and assistant parasitologist, Experiment Station at Davis; **Harold T. Gordon,** assistant insect toxicologist, Experiment Station; **Dilworth D. Jensen, Woodrow W. Middlekauff,** and **A. Earl Pritchard,** assistant professors of entomology and assistant entomologists, Experiment Station; **Ray F. Smith,** instructor in entomology and junior entomologist, Experiment Station; **Francis M. Summers,** principal laboratory technician, Davis; and **Edward S. Sylvester,** instructor in entomology and junior entomologist, Experiment Station.

The Johns Hopkins University has begun construction of a new two-story building intended principally for the School of Engineering and other scientific departments. The building will be named Whitehead Hall, in honor of John Boswell Whitehead, now actively engaged in research as professor emeritus of engineering. Dr. Whitehead served as dean of the School of Engineering from 1920 to 1938 and director from 1938 to 1942, when he received his present appointment. Whitehead Hall will be the first structure at the University to be named for a living person.

Ohio State University scientists have succeeded in concentrating a rare form of helium, "mass 3 isotope," by means of a single-step process. Mass 3 isotope usually exists in the proportion of one part to a million of the normal "mass 4 isotope." The single-step process makes use of mass 4 helium's ability to climb out of its container at low temperatures by means of "film flow," which takes place through a surface layer of liquid helium which forms on the walls of the container. It was found that only the normal mass 4 helium atoms undergo this film flow at a temperature of $1\frac{1}{2}°$ above absolute zero, while the rarer mass 3 atoms remain behind. Since the natural abundance of mass 3 isotope is so small, a huge volume of the element will have to be processed in order to obtain a small quantity of pure mass 3 helium required for further research. The project was carried out by **J. G. Daunt, R. E. Probst,** and **H. L. Johnston,** all of Ohio State. **E. O. Nier,** University of Minnesota, collaborated in some of the early phases of the work. The project is being supported by the Office of Naval Research under contract with the Ohio State University Research Foundation, as one of 6 Navy projects now under way in the Ohio Cryogenic Laboratory.

Meetings

The Fourth Annual Conference on Protein Metabolism, sponsored by the Bureau of Biological Research, Rutgers University, will be held in New Brunswick, New Jersey, February 6–7, 1948. Two sessions on Friday and one on Saturday are planned, at each of which two lectures will be given. Subjects of discussion will be intermediary protein metabolism, accessory substances, endocrine relationships, and therapeutic aspects. The Conference is open to all those interested whose registration is received by January 24. Blanks may be obtained from William H. Cole, Rutgers University. Final arrangements will be announced to registrants by January 28.

The Faraday Society, 6 Gray's Inn Square, London, W. C. 1, is planning a General Discussion on "The Physical Chemistry of Process Metallurgy" for the latter half of September 1948. It is proposed that the discussion will be devoted to the thermodynamics and kinetics of the high-temperature reactions involved in smelting and refining, thus excluding reactions occurring in mechanical working and heat treatment as well as electrochemical processes in aqueous solutions. Thermodynamics will include thermochemical, free energy, and equilibrium studies; kinetics, both chemical reactions and diffusion processes. Readers of *Science* who are interested in attending are invited to forward to the secretary, G. S. W. Marlow, summaries of papers

ting subject matter and method of ment not later than February 1, By March 1 prospective contribu- ill hear concerning the acceptability ir papers.

ctions

e State College of Washington ter of Sigma Xi, Pullman, Wash- n, recently elected the following rs for the current year: H. L. East- Department of Zoology, president; Harris, Division of Industrial Re- h, vice-president; H. Bang, School of macy, secretary; C. M. Stevens, De- ent of Chemistry, treasurer; and Holton, pathologist, U. S. Depart- of Agriculture, Executive Com- e.

e American Association of Col- of Pharmacy elected the following rs at its annual meeting held in con- ion with the American Pharma- al Association, August 24–30, in aukee, Wisconsin: Arthur Uhl, Mad- Wisconsin, president; J. Lester an, Charleston, West Virginia, pres- elect; John F. McCloskey, New ans, vice-president; and Louis C. Iowa City, secretary-treasurer. New bers of the Executive Committee are: Burt, Lincoln, Nebraska, and H. C. on, Boston. B. V. Christensen, umbus, Ohio, was re-elected chairman e Committee.

e Biological Photographic As- ation elected the following officers 1947–48 at its 17th annual meeting Rochester, New York: president, ond J. Farris, executive director, The ar Institute; vice-president, Oscar Richards, chief biologist, American al Company; secretary, Anne Shiras, rtment of Medical Photography, versity of Pittsburgh; and treasurer, a Zimmer, Department of Medical tography, Syracuse University.

RC News

Building Research Advisory rd, under the chairmanship of Frank ewett, formerly president, Bell Tele- ne Laboratories, Inc., and during the president of the National Academy ciences, has been established as a unit e Division of Engineering and Indus- Research. The Board will serve as a ral clearinghouse for information cientific research in the building construction industry, stimulate correlation of research information and coordination of research activities in its fields of interest, assist in dissemination of information on advances in design, materials, methods, and technologies of building construction, and in general further the application of scientific methods for the improvement of building construction practices. Board membership is made up of over 20 academic, industrial, and government men in the fields of scientific research, architecture, engineering, and building construction. The Board, established at the specific request of the Construction Industry Advisory Council of the U. S. Chamber of Commerce, will work closely with a Research Activities Committee of that Council.

The Committee on Drug Addiction has been reorganized as the Committee on Drug Addiction and Narcotics with the following membership: Isaac Starr (chairman), Hon. H. J. Anslinger, Raymond N. Bieter, Dale C. Cameron, Nathan B. Eddy, W. W. Palmer, Maurice H. Seevers, and Lyndon F. Small. At its first meeting on October 2 the Committee elected Dr. Eddy as secretary, with authority to conduct the current studies on metopon. The several problems regarding stock-piling of narcotics as presented by the Surgeons General of the Army and Navy were discussed and definite recommendations agreed upon. It is expected that this Committee will have a very important function in regard to the testing and use of derivatives of amidon now being prepared by the pharmaceutical houses.

Recent Deaths

J. Lindhard, 77, emeritus physiologist of the University of Copenhagen, died October 11 following an operation. Among exercise physiologists he is best known for joint authorship with August Krogh of a series of papers on circulation and respiration, published from 1912 to 1920.

Henryk Hoyer, 83, professor emeritus of comparative anatomy, Jagiellonian University, Kraków, Poland, died October 17. Prof. Hoyer was widely known for his work on the comparative anatomy of blood and lymph vessels of vertebrates.

Clarence O. Cheney, 60, formerly medical director, New York Hospital, Westchester Division, and professor of clinical psychiatry, Cornell University Medical College, died November 4 in the White Plains Hospital following a cerebral hemorrhage.

In pursuance of the provisions of the "Plenary Powers" Resolution adopted by the International Congress of Zoology at Monaco in March 1913, notice is hereby given that the International Commission on Zoological Nomenclature has received the undermentioned applications for the suspension of the *Règles Internationales* on the ground that their strict application would clearly result in greater confusion than uniformity:

(1) **Suppression of books:** to suppress the names in Gesner, 1758, *Tractatus physicus de petrificatis* (146) and in Hope, 1836, *Buprestidae* (57).

(2) **Class Sporozoa:** to validate the current use of the names *Piroplasma* and *P. annulatum*, commonly attributed to Dschunkowsky & Luhs, 1904 (12).

(3) **Class Hydrozoa:** to suppress the name *Graptolithus* Linnaeus, 1768, and to validate the names *Monograptus* Geinitz, 1852, and *Retiolites* Barrande, 1850 (11).

(4) **Class Cephalopoda:** to validate the name *Octopus* Cuvier, 1797 (187); to fix the type of *Ammonites cordatus* Sowerby, 1813 (58).

(5) **Class Brachiopoda:** to validate the use of the trivial name *pecten* for the Silurian brachiopod commonly known as *Strophomena pecten* (Linnaeus 1758) (130).

(6) **Class Pelecypoda:** to preserve the existing usage *Erycina* Lamarck, 1805 (69); to emend the spelling of *Palaeneilo* Hall, 1869 (62).

(7) **Class Insecta, Order Coleoptera:** to validate the current use of the names: *Bradycellus* Erichson, 1837; *Carabus* Linnaeus, 1758; *Harpalus* Latreille [1802–03]; *Ophonus* Stephens, 1827; *Lebia* Latreille [1802–1803]; *Tachys* Stephens, 1828; *Trechus* Schellenberg, 1806 (158); to emend the spelling of *Hygrioba* Latreille, 1804 (159).

(8) **Class Insecta, Order Hemiptera:** to validate the currently accepted use of the names of the following genera: *Aquarius* Schellenberg, 1800; *Bellocoris* Hahn, 1834; *Beosus* Amyot and Serville, 1843; *Catoplatus* Spinola, 1837; *Dictyonota* Curtis, 1827; *Gastrodes* Westwood, 1840; *Oncotylus* Fieber, 1858; *Pachylops* Fieber, 1858; *Pilophorus* Hahn, 1826;

Tetyra Fabricius, 1803 (144); to validate specified uses of the names *Alydus* Fabricius, 1803, and *Salda* Fabricius, 1803 (161).

(9) **Class Insecta, Order Hymenoptera:** to suppress the name *Clavellarius* Olivier, 1789 (120); and to validate specified uses of the following names: *Ceratina* Latreille, 1802–03; *Diodontus* Curtis, 1834; *Formica* Linnaeus, 1758; *Camponotus* Mayr, 1861; *Gorytes* Latreille, 1804; *Hoplisus* Lepeletier, 1832; *Harpactus* Shuckard, 1837; *Macropis* Panzer, 1806–09; *Megilla* Fabricius, 1804–05; *Megachile* Latreille, 1802; *Methoca* Latreille, 1804; *Notozus* Förster, 1853; *Nysson* Latreille, 1796; *Odynerus* Latreille, 1802–03; *Ponera* Latreille, 1804; *Rhopalum* Stephens, 1829; *Solenius* Lepeletier & Brullé, 1835 (135); to preserve the trivial components of the specific names *Vesper arvensis* Linnaeus, 1758, and *Apis agrorum* Fabricius, 1789 (135).

(10) **Class Insecta, Order Lepidoptera:** to remove doubts regarding the validity of the following Fabrician names published in 1807: *Apatura, Castnia, Emesis, Helicopis, Neptis, Urania* (148).

(11) **Class Pisces:** to validate the name *Raphistoma* Rafinesque, 1815 (145).

(12) **Class Mammalia:** to determine the type of *Chinchilla* Bennett, 1829 (141).

(13) **Class Cephalasidomorphi:** to validate the current use of *Trematapis* Schmidt, 1866, by designating *T. schmidti* Rohen, 1892 as its type (123).

(14) **Class Aves:** to fix the type of *Dinornis novae-zealandiae* Owen, 1843 (136).

The undermentioned applications may also involve the suspension of the *Règles* for their solution:

(a) **Class Gastropoda:** *Acmaea, Acme,* and *Acmea* (27).

(b) **Class Insecta, Order Coleoptera:** *Leiodes* Latreille, 1796 (64).

(c) **Class Insecta, Order Hemiptera:** *Corixa* Geoffroy, 1762 (137).

(d) **Class Arachnida, Order Acarina:** *Liodes* Heyden, 1826 (64).

(e) to determine the status of Martin (W) 1809, *Petrificata derbiensia* (147).

Zoologists wishing to comment on any of the above applications are particularly requested, when communicating with the Commission, to quote the file number which appears in parentheses at the end of each entry in the foregoing list. Full particulars in regard to all the above items, except the first item in (4), have been published in the *Bulletin of Zoological Nomenclature.* Particulars in regard to (4) will be found in the appendix to Opinion 166. All communications in regard to the above cases should be addressed to the Secretary to the International Commission on Zoological Nomenclature, Francis Hemming, 83 Fellows Road (Garden Flat), London, N.W.3, England.

The American Statistical Association, 1603 K Street, N. W., Washington 6, D. C., is now publishing *The American Statistician,* which replaces the *ASA Bulletin* as the news publication of the Association. The new journal, to appear each year in February, April, June, August, October, and December, under the editorship of **Sylvia Castleton Weyl,** will supplement the Association's technical publications and serve as an editorial medium, will present discussions of the uses of statistical methods in various fields, and will open its columns to questions and answers as well as to the presentation of problems. The first issue appeared in August. The subscription price is $1.50 or 25¢ a copy.

November 3 and 4 marked two anniversaries of interest to scientists. **John F. Fulton,** of Yale University School of Medicine, who is delivering the Heath Clark Lectures in London this month and who was the only American attending the events, has forwarded to *Science* the following accounts:

In Greyfriars' Churchyard at Edinburgh on November 3 there was a simple but impressive ceremony at the grave of James Hutton, M.D., F.R.S.E. (1726–97), commemorating the 150th anniversary of his death. Eloquent tribute was paid to "the founder of modern geology" by Lord Provost Sir John Falconer and by the Rev. Dr. D. W. P. Strang of Greyfriars as a tablet was unveiled to his memory.

In the afternoon Sir Edward B. Bailey, F.R.S., delivered a memorial address to the Royal Society of Edinburgh, emphasizing particularly Hutton's unpublished *Principles of agriculture,* far less well known than his classic *Theory of the earth.* Were the "Principles" to be published today, it would take its place among the great books of science. The subject matter is comprehensive—for example, one sentence from a discussion of possible diversification of species by natural selection reads: "Where dogs are to live by the swiftness of their and the sharpness of their sight, the best adapted to that end will be the certain of remaining, while those which are the least adapted to this ner of chase will be the first to per This was written by a man who die years before Charles Darwin was

In all his writings Hutton saw the w ing of a single great idea, a balance o powers of Nature which led to ne ending cyclic continuity. When he n destruction in one direction, he fo proof of reconstruction in another. the words of the Lord Provost when veiling the memorial tablet: "It is fo to be grateful to men like Hutton, w patient endeavours have made for progress of the world. He developed logical ideas far in advance of his ti

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On November 4 there was ano anniversary of interest to scientists world over. It was just 100 years s Prof. James Y. Simpson and two as ants had sat around the dining tabl his house at 52 Queen Street and inh the fumes of chloroform. The memor event has been marked at Edinburgh appropriate ceremonies, beginning a scientific meeting at which the us chloroform at the present date was cussed by R. R. Macintosh, D. S. Mid ton, and John Gillies. Honorary deg were conferred upon Henry Walter Fe erstone, founder-president of the A ciation of Anaesthetists of Great Brit and Thomas Blantyre Simpson, K grandnephew of Sir J. Y. Simpson. the afternoon there was an address Douglas Guthrie, author of *The hi of medicine.*

The house of Simpson, whose use chloroform to ease the pain of childb was decried by the clergy, has now b turned over to the Church of Scotland be used as a center for the training youth in Christian leadership.

The Office of Technical Servic Department of Commerce, has relea for sale the third volume of a comp hensive *Index* to the thousands of rep on wartime technological developme in the United States, Germany, other foreign countries, which is intend for use with the *Bibliography of scien and industrial reports,* which has b published weekly since January 19 The third volume of the *Index* provide reference to the issues of the *Bibliogra*

n October 4 to December 27, 1946, l also includes reference to the German ents in chemistry, electronics, scien- instruments, photographic equip- nt and processes, and transportation ipment which were listed in the *liography* during this period. The *lex* is elaborately cross-referenced, and h entry lists the file number of the ort and the page number of the *liography* where an abstract of the ort may be found. The three volumes the *Index* (35¢ each for Vols. 2 and 3, l 50¢ for Vol. 1), and the *Bibliography*, ich is $10 a year, may be obtained m the Superintendent of Documents, S. Government Printing Office, Wash- gton 25, D. C. Orders should be accom- nied by check or money order, payable the Treasurer of the United States.

The 10th six-week course in the aboratory Diagnosis of Parasitic iseases will be given January 12–Feb- ary 20, 1948, by the Laboratory ivision of the Communicable Disease enter, U. S. Public Health Service, 291 achtree Street, Atlanta, Georgia. The urse is given primarily for the Division's boratory personnel and that of state l local public health departments, but plicants from hospitals and private boratories will be gladly considered if ere are vacancies. There is no tuition , but living and travel expenses must assumed by the individual. Two other milar courses will also be given July 12– ugust 20, and October 11–November 19, 48. Applications for all courses should made as far in advance as possible. otification of acceptance will be made out two months before each course gins so that states may have time to range budgetary allotments. Laboratory rectors and senior staff members wishing attend any of these courses may do so. owever, it is proposed to schedule one or o short courses in the same subject for ese individuals. Definite dates for these o-week courses have not been set. hose interested should notify the Labo- tory Division which of the following tes would be most suitable for them, ving first and second choice: March 19; May 10–21; and December 6–17, 48.

The Building Research Station, epartment of Scientific and Industrial esearch, Great Britain, is making a orough study of homes to discover the aximum comfort that can be achieved with a minimum amount of fuel, a project of great importance in Great Britain's present fuel crisis. Two large-scale experiments are being carried out. The first, which is concerned with thermal insulation of houses, is being undertaken on 8 specially built similar houses with identical heating systems but different types of insulation. Families have been living in the houses for more than a year while the experiments continue. The reverse conditions are present in the second experiment of 20 houses with similar insulation but different heating systems. In the initial part of each experiment, the houses are occupied only by a theoretical family consisting of four people. The amount of all in-coming and out-going heat is recorded, and 92 different electrical appliances are tested. In the second part of the experiment, real tenants continue recording the necessary data, but do not, of course, have to follow the pattern of the theoretical family. As the result of these experiments, it will be possible to deduce what appliances and methods of construction are best. It is already possible to give such advice on the basis of the initial laboratory experiments, but these must first be tested under actual living conditions before the results will be freely available to the building industry and the public.

The U. S. Atomic Energy Commission has appointed a Board of Consultants to help speed the development of atomic power plants and industrial opportunities in the atomic energy field. Chairman of the Board is James W. Parker, president and general manager, Detroit Edison Company. Other members include: O. E. Buckley, president Bell Telephone Laboratories, New York; Donald Carpenter, vice-president, Remington Arms Company, Bridgeport, Connecticut; Gustav Egloff, director of research, Universal Oil Company, Chicago; Paul Foote, executive vice-president, Gulf Research and Development Company, Pittsburgh; Robert G. Wilson, chairman of the Board, Standard Oil Company of Indiana, Chicago; and Walker Cisler, chief engineer of power plant, Detroit Edison Company, and consultant to the AEC, who will serve as executive secretary of the Board.

The Veterans Administration has established a Laundry and Textile Laboratory at Bedford, Massachusetts, Veterans Administration Hospital, which, by testing and evaluating supplies, preparing specifications and technical bulletins, developing proper and improved cleaning practices, conservation of textiles and determining their suitability to resist cleaning operations, and distributing a laundry test bundle for operation control purposes, will exercise technical control over the 100 hospital laundries and 20 hospital dry-cleaning plants now operated by the Veterans Administration throughout the country. **Hubert C. Normile,** formerly head, Chemical and Plastics Section, Research and Development Division, Philadelphia Army Quartermaster Depot, is technologist in charge of the new laboratory, which will later be located at the new Franklin Delano Roosevelt Hospital, now under construction at Peekskill, New York.

The National Registry of Rare Chemicals, 35 West 33rd Street, Chicago 16, Illinois, list the following wanted chemicals: benzyl hyponitrite; galactoflavin; di-α-pyridylamine; 3,4,5-trihydroxyphenanthrene; coniferin; α-truxillic acid; β-truxinic acid; cis cinnamic acid; 3,5-dibromosalicylaldehyde; 2-methyl-3-hydroxy-4-pyrone; p,p′-dibutyldiphenyl sulfide; chlorogenine; digitogenine; methyl chloramine; ethyl chloramine; 2-pyridoin: 2-pyridylaldehyde; barium hypobromide; pyrotartaric acid; brazan; mescaline; and eicosyl alcohol.

Make Plans for—

American Mathematical Society, November 28–29, Washington University, St. Louis, Missouri.

American Society of Mechanical Engineers, December 1–5, Chalfonte-Haddon Hall, Atlantic City, New Jersey.

National Council of Geography Teachers, December 27–29, Charlottesville, Virginia.

American Society for Professional Geographers, December 27–30, Charlottesville, Virginia.

American Anthropological Association, December 28–31, Albuquerque, New Mexico.

American Association for the Advancement of Science, 114th Meeting, December 26–31, Chicago, Illinois.

COMMENTS
by Readers

During the war and throughout the two years since its conclusion, the problem of the study of foreign languages, as related to scientists in general, has taken on new importance. At no time in history has it been so necessary to keep abreast of the technological developments of foreign countries as now. This fact, coupled with the tendency of students to avoid the serious study of foreign languages, makes it advisable to review the problem briefly, with particular emphasis on the language requirement for the Ph.D. degree. The war initiated intensive methods into the study of languages. It became necessary for more persons to know foreign languages and to know them better than previously. The rather large number of persons who had "passed" German and French at some previous time in fulfilling the requirements for the Ph.D. found that their knowledge of the languages was entirely inadequate. As a consequence, it now appears to many that in the field of science something should be done to rectify the situation.

There are two obvious difficulties in the present method. One is that the scientist often does not come into contact with foreign languages—except for the high school exposure, if any—until he has passed beyond the M.S. degree. Second, his contact with languages in the Graduate College is insufficient to be of any real use to him. Two alternatives exist: either the language requirement can be eliminated or more intensive training in one language can be substituted. The first alternative is contrary to the present trend and necessity; the second suffers from lack of support on the part of educators concerned with the particular problem. In support of the second alternative there may be listed the following:

(1) The student may make effective use of the language earlier in his school career.

(2) A good knowledge of one language has a cultural value which the M.S. or Ph.D. in science cannot afford to miss, especially in this era when scientists must take a greater part in world affairs.

(3) The student is released from the wasteful procedure of cramming for two language exams which he has come to look upon as mere formalities.

Assuming that one language would be acceptable for the Ph.D. requirement, it is, of course, a problem to make a selection. One may attempt to determine the most useful language, from a technical standpoint, by statistical means, but it must not be assumed that every student should be required to study the most widely used language. A balance must be maintained so that all the useful languages are reasonably well represented in any department at any one time. On the other hand, a student should not be required to take a minor language just to maintain some kind of a percentage balance.

It seems that the bases upon which to select languages should be somewhat as follows:

(1) What language will be of most use to the student in his field?

(2) In what language is the student particularly interested?

(3) Which languages does the student already know?

The first of these questions can be partially answered by making a survey of the frequency of references to articles in foreign languages appearing in abstract journals. As an illustration, the references to technical articles for one year, 1940, in the *Wireless Engineer* have been checked in the fields of wave propagation, circuit theory, electronics, and transmission with the following result: German, 100 references; Russian, 57; French, 48; Italian, 23.

In any particular case, with information such as this for the field under consideration, the adviser may come to a satisfactory agreement with the student concerning his language requirement. The question is of such importance that every effort should be made to readjust the treatment of the language requirement not only for the Ph.D. degree but for science students in general. (L. A. WARE, *State University of Iowa.*)

In a report entitled "Calcium
Growth in Aging and Cancer" (
I. Lansing. *Science*, August 29, p. 187)
are given regarding the calcium co
of cells. These data clarify some a
of aging and, at the same time, e
the reason for the low calcium conte
cancer cells. However, the clarifi
introduces new difficulties. The para
revealed that cancer, an actively gro
young tissue low in calcium, occurs
taneously most frequently in an ol
sue high in calcium and which is no l
actively growing. More than thi
young organisms, relatively low in
cium, cancer occurs with far les
quency. It does not help to say
locally rejuvenated old tissue growi
an old organism might be expecte
create havoc, for it has been demonst
time and again that embryonic t
transplanted in older tissue does no
have at all like cancer, even though
bryonic tissue has a low calcium con
Nor can a lack of cell adhesiveness
incriminated to explain malignancy
reduction of adhesiveness of fibrous t
cells does not render them malig
Malignancy, characterized by a d
destructive action by cancer cells
somatic cells, is not duplicated by
dering, actively growing somatic
Therefore, although the decreased a
siveness of cancer cells can be correl
with their markedly low calcium con
their *destructive* invasiveness cannot
thus explained.

Malignancy is an inherent propert
cancer cells independent of their cal
content. On the other hand, increas
the calcium environment of cancer
may increase their adhesiveness and
sequently possibly decrease their i
siveness and thus limit their malign
by limiting their movement. This m
constitute a rational basis for the u
calcium in cancer therapy, as is occas
ally recommended.

The reduction of calcium in met
cholanthrene-induced epidermal hy
plasia does not represent a neces
herald of the onset of cancer, for hy
plastic tissue is young tissue, and
calcium content is relatively low.

The low calcium content of cancer
sue simply accompanies its youth
does not explain its malignancy.
therefore not logical to imply a lin
between cancer cells and somatic cel
the basis of a decreasing content in
calcium. The behavior of cancer
negates the proposition that they re

sent an extrapolation of somatic cells unless a marked saltatory change is assumed. But this assumption requires the additional postulate that a young, aggressive, low-calcium cell can result from a qualitative transformation of an old, passive, high-calcium cell and that this singular process takes place with astonishing regularity and with far greater ease than a similar transformation into a cancer cell of a young, actively growing somatic cell likewise low in calcium.

The fundamental behavior and properties of cancer cells are more fruitfully compared with another primitive tissue—the mammalian trophoblast or, more generally speaking, the asexual generation of the vertebrate life cycle. In making this comparison it is not necessary to resort to postulates not already well established. (CHARLES GURCHOT, *The John Beard Memorial Foundation, 1095 Market Street, San Francisco.*)

The recent paper by Blackwelder, Knight, and Sabrosky (*Science*, October 3, pp. 315–316) concerning proposals for clarifying Article 19 of the International Rules of Zoological Nomenclature deserves high merit, and it is to be hoped that the International Congress of Zoology—the only body with power to amend the Code—will pass favorably upon it when the group meets in Paris during July 1948. By way of introduction, the authors of the proposal write, "Obviously, each genus or species of animal can have only one valid name spelled in only one way . . . great confusion can result if each author is free to spell any name in the way that pleases him most."

With this in mind, I am prompted to write, because in the same issue of *Science* (p. 327) Seaman, in violation of the rules, refers to a species of *Paramecium* which he italicized as *Paramecium nucleatum* and which is presumably meant to be *Paramecium multimicronucleatum*.

The first to use the name *P. nucleatum* for this well-known, well-defined species was Mast (*Biol. Bull.*, 1947, **92**, 31–72), who stated in a footnote, "The name "*multimicronucleatum*" is so long and unwieldy that the abbreviation, *nucleatum*, will hereafter be used in place of it" (italics his). *Paramecium nucleatum* is thereby used, in italics as a species name, in the remainder of his paper.

In view of the large amount of research that is being done now and that has been done in the past upon cultivation, cytology, serology, mating types, and conjugation, confusion is bound to be the result if two names are used for this well-defined species. It is to be hoped that its valid name, *Paramecium multimicronucleatum*, be retained and used in future publications. (RALPH WICHTERMAN, *Biology Department, Temple University, Philadelphia.*)

R. W. Gerard's communication on the subject of the editing of scientific papers (*Science*, September 26, p. 289) reopens a perennial question which must be of interest to most readers of *Science*.

The problem rests, clearly, on the respective rights of editor and author. It can be solved very easily and correctly, I believe, by examining a little more closely than Prof. Gerard does the common basic assumptions regarding these respective rights. (What I have to say here concerns journal editing only; the editing of symposia and other collaborative works obviously involves a rather different set of problems.)

Editors, or their equivalents, are necessary evils, it must readily be granted by even the most disaffected. There must be liaison among a journal's publisher, authors, printer, and consumers; there are decisions regarding content and make-up that require an over-all control. But it is after this that, in my opinion and in Prof. Gerard's words, "the pendulum swings over."

Why should an editor be entitled to insist on a certain spelling, on particular abbreviations, and on a set form of literature-citation? Except for the last (where standardization, if it could be achieved, would benefit the indexers), I don't know. Do you?

Why should you, as author, and I, as editor, waste time haggling over what I conceive to be your errors of spelling, punctuation, and grammar? I don't know. Do you? Is it to mislead posterity, and your contemporaries who don't know you, into believing that you are more literate than you are? (Because it is your name only that they will connect with the paper.) Or is it to feed my ego by making you over as closely as possible into my literary image and likeness?

Why, if you are more literate than I and object to my attempt to bring you into line, should you be forced to submit your paper elsewhere when my journal is the one in which it properly belongs; when there is no other equally appropriate journal; or when, if there is, its editor is as autocratic as I am? I don't know. Do you?

It is the editor's right and responsibility, agreed, to say what papers and other material shall appear in his journal, to plan its make-up, and to facilitate its orderly production. Beyond that, four courses are open to him: (1) he may stop there; (2) he may insist upon certain literary uniformities; (3) he may insist only upon accuracy of statement and citation; (4) he may go whole hog and "vet" the manuscript.

Now, there are moral and historical aspects of this problem which might be thought to condition the editor's choice of these courses.

Anything printed becomes at once a potentially active contemporary force and a part of the historical record of the time. That being the case, the editor of a scientific journal would seem to have a strict responsibility (1) to serve the present by not publishing anything contrary to established fact; (2) to serve the present and posterity by presenting our authors faithfully in whatever state of literary grace each may have reached.

His selection of papers, the knowledge that they are factually reliable, his judgment in the matter of accessory material, his taste in the make-up of the journal, should obtain for the editor all the recognition he properly should seek. He is not, or should not be, a schoolmaster. A man old enough to write a scientific paper acceptable for publication on its scientific merits is a man old enough, one would think, to be permitted to express himself in his own way (or his secretary's), within the limits of space deemed suitable by the editor. If his way be literarily inept; if he have no literary conscience at all—so much the worse for him. Let him appear to his fellows and to posterity as he is. The ends of truth and progress are in no way furthered by "editing" him.

In short, I beg to suggest that, if editors were to drop the pedagogic mantle and confine their editing of typescripts to the correction of factual inaccuracies, the ends of science, progress, and history would be better served; and, as a little extra dividend, editors and authors might well become, as if by magic, the best of friends. (W. B. MCDANIEL, II, *librarian and editor, College of Physicians of Philadelphia.*)

TECHNICAL PAPERS

Effect of Tetraethyl Pyrophosphate on Sympathetic Ganglionic Activity

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This is a further report on the employment of anticholinesterases with reference to the nicotinic effect of ACh, dealing particularly with the most recently discovered antiesterase tetraethyl pyrophosphate (TEP). The nicotinic (ganglionic) effect of various doses of ACh was measured in terms of the pressor response in *atropinized* dogs treated with TEP. Ten γ of TEP/kg. of body weight was sufficient to elicit pressor responses with moderate doses of ACh (0.05–0.10 mg./kg.). With progressively increasing doses of TEP, the pressor response to two standard doses of ACh (0.125 and 0.25 mg./kg.) could be measured, and a curve relating TEP concentrations with the magnitude of the pressor response could be drawn.[1]

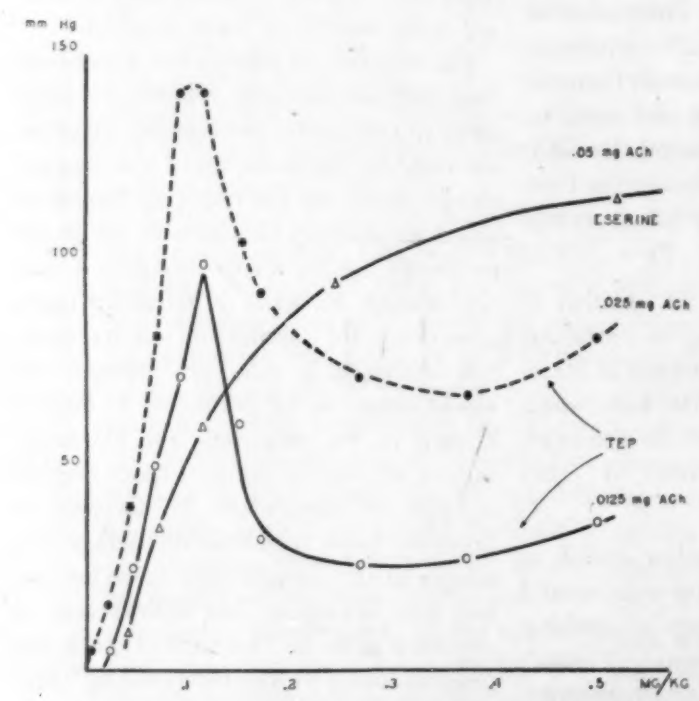


FIG. 1. Pressor response in atropinized dogs to acetylcholine after administration of increasing concentrations of TEP and eserine. (Abscissa—concentrations of the antiesterase in mg./kg.; ordinate—pressor response in mm. of Hg of blood pressure.)

This curve shows two peaks (Figs. 1 and 2), one following the sharp increase in pressor response when from 0.01 to 0.1 mg./kg. of TEP was administered, and another corresponding to the total amount of TEP of 15 mg./kg. A dip of pressor response with a minimum value (varying for individual dogs) for the total concentration of TEP of about 0.25 mg./kg. separates the two peaks. The second peak exceeded the first by some 20–33 mm. of Hg. Continued administration of TEP resulted in diminution of pressor response of ACh until none could be elicited at TEP levels of about 70 mg./kg. Under favorable conditions atropinized dogs survived with as much as 140 mg./kg. Thus, TEP proved to be a more powerful antiesterase than any previously reported. The initial maximal pressor response to ACh appears at the following levels: DFP, 15–20 mg./kg.; eserine, 0.5 mg./kg.; hexaethyltetraphosphate (HETP), 0.5 mg./kg.; and TEP, 0.1 mg./kg. (*5*, *7*; see also Table 1).

It has been postulated in a previous communication (*7*) that the measurements of the pressor responses to standard doses of ACh in the presence of varying concentrations of different anticholinesterases could be used as an ***in vivo*** estimate of the inactivation of the cholinesterase. The present study of TEP further substantiates this assumption. Table 1 compares the estimated concentrations of the different antiesterases necessary to inactivate 50 per cent of the cholinesterase ***in vivo*** with the results obtained ***in vitro*** by several investigators. Since the

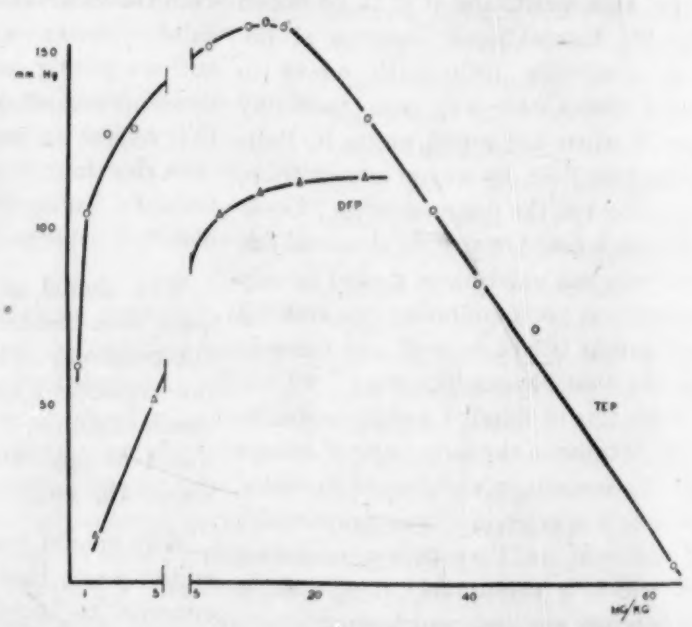


FIG. 2. Pressor response in atropinized dogs to acetylcholine after administration of increasing concentrations of TEP and DFP. Test dosages of acetylcholine: 0.0125 mg./kg. for TEP; and 0.05 mg./kg. for DFP. (Abscissa—concentrations of the antiesterase in mg./kg. Effect of the lower concentrations is not apparent on this scale (cf. Fig. 1); ordinate—pressor response in mm. of Hg of blood pressure.)

latter experimented on animals other than the dog, only a general agreement can be expected. On the whole, the inhibition of the cholinesterase is obtained ***in vivo*** with smaller concentrations of the antiesterases; thus, the method presented here seems to be more sensitive than the ***in vitro*** method. At the first peak of the pressor response, representing approximately 100 per cent inactivation point of esterase, TEP seems to be

[1] All drugs were administered in these experiments by injection into the femoral vein. Artificial respiration had to be given to dogs that received more than 1 mg./kg. of TEP.

two to three times as potent as eserine and HETP and times as potent as DFP. However, since the early parts inactivation curves of cholinesterase by specific antises are steep and differ in character (unpublished re- the comparative estimate of the potency of the anti-

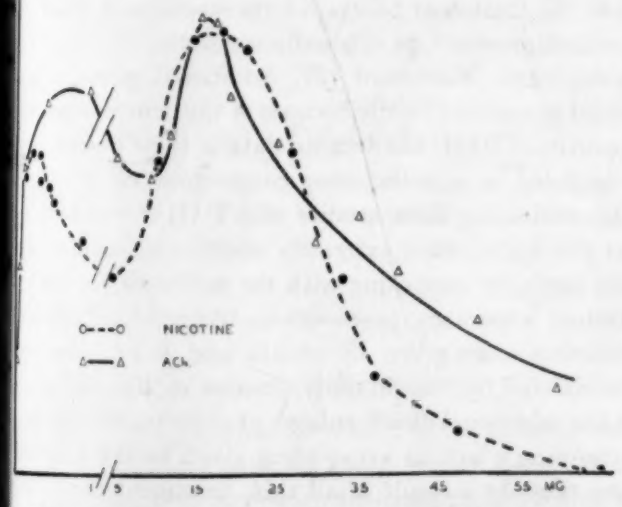
TABLE 1

IVITY OF ACETYLCHOLINESTERASE TO VARIOUS ANTIESTERASES

	DFP	HETP	Eserine	TEP
	Molar concentrations of inhibitor required to produce a 50 per cent inhibition of cholinesterase activity			
cord (1).....	3.0×10^{-6}	4.0×10^{-6}	1.0×10^{-8}	—
serum (6)..	5.0×10^{-7}	—	5.0×10^{-6}	—
erum (6)....	1.3×10^{-8}	—	—	—
ach serum	—	1.0×10^{-7}	—	—
in (3).....	6.3×10^{-8}	1.6×10^{-8}	—	—
,5,7).....	5.0×10^{-9}	4.0×10^{-10}	9.5×10^{-11}	8.5×10^{-11}
	Molar concentrations of the inhibitor required to produce a 100 per cent inhibition of cholinesterase activity			
rum (3).....	—	2.0×10^{-9}	—	—
,5,7).....	7.5×10^{-8}	1.0×10^{-9}	7.9×10^{-10}	3.3×10^{-10}

es may differ, depending on whether the 50 or 100 per nactivation point is taken as the index of activity. (See 1, specifically with reference to HETP and eserine.)

e efficiency of TEP seems to be especially remarkable, in the presence of a wide range of its concentrations as



3. Pressor response (ganglionic effect) in atropinized dogs to nico- 1 mg./kg.) and acetylcholine (0.05 mg./kg.) (Abscissa—concentra- f eserine in mg./kg.; ordinate—pressor response in mm. of Hg of ressure.)

a dose of ACh as 0.8γ/kg. is sufficient to elicit pressor ses. This figure compares favorably with that of Dale (*2*) for the minimum amount of ACh necessary to stimulate se intra-arterial injection the striated muscle of the frog, with the minimal amounts previously estimated to be sary to produce sympathetic ganglionic effects.

e second peak of the pressor response of ACh (Fig. 2), occurs at considerable levels of TEP ranging from 15 to /kg., is of particular interest. A similar peak occurs when ntiesterase used is eserine (Fig. 3; unpublished results). Also, the pressor effects of nicotine itself followed a double-peak curve with increasing amounts of eserine (Fig. 3). It is therefore tentatively suggested that the biphasic response to ACh elicited within a wide range of concentrations of different antiesterases is due to the effect of the latter on the sympathetic ganglia. The ganglia seem to be first depressed, and then, with higher concentrations of the antiesterases, rendered more responsive. Further research must determine whether this effect of the antiesterases on the ganglia is a direct one or related to the mechanism of the synaptic transmission.

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The Influence of Heredity on the Carotene Content of Corn[1]

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The extensive use of hybrid corn in recent years has emphasized the question of possible relationships between the heredity and nutritive content of corn and the possibility of producing hybrids of superior nutritive value. The early work of Hauge and Trost (*2*) pointed out that ordinary genetic factors controlled the vitamin A activity of dent corn, the genes responsible being the same as those governing development of the yellow endosperm. Recently Doty and associates (*1*) have reported that there is some indication that the amounts of the various amino acids in corn protein are related to the genetic constitution of corn hybrids, and that the physicochemical nature of the protein in the grain from two single cross hybrids was distinctly different. In general, however, information is lacking relative to the influence of the genetic constitution of corn on the nutritive value of the grain.

In the course of a comprehensive investigation dealing with this subject, crude carotene values were determined on the grain from all possible single cross combinations of 10 inbred lines of yellow dent corn, all of the same general maturity class and grown during the 1946 season. A 7 x 7 triple lattice design was used in the field experiment, thus providing for analysis three replicate samples of grain for each single cross. The field experiment was conducted near Chambersburg, Pennsylvania, the soil type and fertilizer treatment being the same on the three plots.

The corn was harvested at maturity, and the shelled corn was air-dried at room temperature for 10 days and stored in

[1] This investigation was supported by a grant from the Pennsylvania Farm Supply Cooperatives.

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air-tight containers at 0°C. until it was analyzed. Carotene estimations were made by the official A. O. A. C. method (*3*), modified by the use of Hyflo Supercel and magnesium oxide, 3:1, as the chromatographic adsorbent.

Seed was not available for the Iowa I205 x Ohio 28 cross; hence, the carotene value for this combination is missing from the data. The range of yields of the other single cross combinations tested was from 71 to 123 bushels/acre.

The average difference between the highest and lowest of the three carotene values for the individual single crosses was of the order of 17 per cent, the values given in Table 1 being

TABLE 1

CAROTENE CONTENT OF CORN

(mg./lb.—15.5 per cent moisture basis)

	Nebraska 6	Wisconsin 8	Illinois M14	Illinois A	Indiana WF9	Ohio 28	Wisconsin 32	Ohio 51A	Wisconsin 22	Iowa I205
Nebraska 6		1.91	1.64	1.50	1.41	1.30	1.48	1.09	1.08	.67
Wisconsin 8	1.91		1.68	1.27	1.27	1.17	1.31	1.01	.88	1.07
Illinois M14	1.64	1.68		1.26	1.23	1.03	.93	1.17	.84	.70
Illinois A	1.50	1.27	1.26		.97	.95	.95	.93	.79	.66
Indiana WF9	1.41	1.27	1.23	.97		.93	.98	.79	.74	.62
Ohio 28	1.30	1.17	1.03	.95	.93		.88	.66	.72	—
Wisconsin 32	1.48	1.31	.93	.95	.98	.88		.79	.73	.58
Ohio 51A	1.09	1.01	1.17	.93	.79	.66	.79		.60	.53
Wisconsin 22	1.08	.88	.84	.79	.74	.72	.73	.60		.69
Iowa I205	.67	1.07	.70	.66	.62	—	.58	.53	.69	
Inbred line averages	1.34	1.29	1.16	1.03	.99	.96	.96	.84	.79	.69

Least significant difference between single crosses = .19 mg.

the means for three duplicate estimations. These data show that there are striking significant differences between the carotene contents of some of the inbred lines, irrespective of the lines with which they were crossed. On the average, combination of Nebraska 6 and Wisconsin 8 with other inbreds produced corn with the highest carotene content, while all crosses employing Iowa I205 were relatively low. The combination of Nebraska 6 with Wisconsin 8 produced corn with the highest carotene value of all the crosses.

The superior value of yellow corn over white corn as a source of carotene has been recognized for many years. However, little attention has been paid to the fact that different strains of yellow corn may vary greatly in carotene content among themselves. The results presented here show that the genetic constitution of corn may be responsible, in large part, for its content of carotene, and that, all other conditions being the same, different strains of yellow corn may vary widely in carotene content. The results suggest further that, in the development of new corn hybrids, attention should be given to the content of important nutritive factors, among which carotene is but one. Further work along this line is now in progress.

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Enhancement of Penicillin Blood Leve Following Oral Administration of Caronamide

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Daily dosages of 5,000,000–40,000,000 units of pen were required with or without enhancing agents in treat of the last 15 patients of a consecutive series of 150 ca subacute bacterial endocarditis infected with nonhem streptococci, including the resistant *Streptococcus* s.b.e. (The penicillin was administered by continuous venoclys a span of at least 8 weeks, which was made possible techni by the conjoint use of heparin in the treatment program. T 15 patients, most of whom were treatment failures with cillin per se before being admitted to our Clinic, receiv total of 66,000,000–4,000,000,000 units of penicillin, the age being 630,000,000. At times streptomycin was also incl in the treatment program. Of these 15 refractory patien (20 per cent) were unequivocal treatment failures despite t massive dosages, and 12 (80 per cent) were salvaged and sidered cured by all clinical and laboratory criteria.

Early in our experience with this type of patient, it found necessary to resort to agents for enhancing penic blood levels, primarily to obtain therapeutic values and to conserve limited supplies of penicillin. In our studie connection with the treatment of a case of subacute bact endocarditis infected with *Veillonella gazogenes* (*10*), cur levels of penicillin were obtained only by means of incorpo ing in the treatment program large amounts of PAH (sod p-aminohippurate), as originally suggested by Beyer, Flip Verwey, and Woodward (*2*). Additional patients simil treated were cured chiefly because of the penicillin-augmen properties of PAH; the detailed data of these observations be included in a forthcoming communication (*7*).

In conducting these studies with PAH it was soon evi that this agent, while extremely effective in augmenting p cillin levels by competing with the antibiotic for the tub excretory apparatus, poses serious technical difficultues. I ineffective when given by mouth and must necessarily administered by vein in daily dosages of 200–240 grams. has the additional disadvantages of unpleasant side-effects a sclerosing effect on veins when given in the requisite c centration. As a result of all this, treatment cannot be c tinued uninterruptedly for any extended period.

Acknowledging the limitations imposed by intraven administration and the necessity for large dosages of PA new approach was sought by Beyer (*1*) which resulted in development of the compound, caronamide (4′-carboxyphe methanesulfonanilide). Beyer found that the excretion penicillin by a renal tubular transport mechanism could physiologically inhibited reversibly. The basis for this e is thought to be one of substrate competition between p cillin, which is excreted by the tubular, and caronamide, w is essentially refractory to excretion by that transport me nism.

The purpose of this report is to present data indicating capacity of orally administered caronamide to effectively

hance penicillin blood levels in a group of patients where excessively high levels are essential for cure. In these patients, infected with relatively insensitive organisms, enhancing agents are virtually indispensable for obtaining necessary amounts of the antibiotic in body fluids. A comparative study regarding the merits of various enhancing agents has been completed and will be the subject of a subsequent report (*8*).

Caronamide[1] was administered for 2–19 days to 9 patients (Table 1) with subacute bacterial endocarditis who were receiving conjoint intravenous penicillin-heparin therapy manner with heparin to facilitate free, uninterrupted flow of the antibiotic.[3] All the blood-level testing was done on blood samples drawn during rigidly controlled runs to insure the designated test dosage.

Enhancement of penicillin blood levels was obtained in every instance where 3 grams was used every 4 hours. Eight of our patients had a mild degree of renal disturbance, which may or may not have had some bearing on the results obtained. In no instance did caronamide aggravate the pre-existing renal disorder. Accepting the dosage of 3 grams every 4 hours as

TABLE 1

PENICILLIN BLOOD LEVELS FOLLOWING COADMINISTRATION OF PENICILLIN AND CARONAMIDE IN 9 CASES OF SUBACUTE BACTERIAL ENDOCARDITIS

Case No.	Infecting organism	Daily dosage of penicillin i.v. (Oxford units times 1,000)	Oral caronamide		Penicillin blood levels (avg. Oxford units/ml.)			Urinary findings	Side-effects of caronamide
			Dosage (grams every 4 hrs.)	Total days administered	Control	After caronamide	Times enhanced		
(1) S. N.	*Streptococcus viridans*	5,000	2	2	3.75	4.00	0	Trace of albumen; occasional rbc and wbc.	
(2) E. S.	" s.b.e.	5,000	2	2	1.5	1.5	0	Occasional rbc and wbc.	Nausea
(3) A. H.	" s.b.e.	1,000	2	2	0.05	0.05	0	Trace of albumen and occasional rbc and wbc; reducing substance.	
		2,500	2	2	0.15	0.75	5		
		20,000	2	12	2.6	2.6	0		
		20,000	3	3	2.6	12.3	4+		
(4) H. K.	" *viridans*	5,000	2	2	13.75	60.0	4+	Trace to 3 plus albumen; wbc.	
		5,000	3	2	13.75	65.0	4+		
(5) I. B.	" s.b.e.	10,000	2	2	6.0	7.5	0	Reducing substance.	
		10,000	3	2	6.0	20.0	3+		
(6) H. B.	" s.b.e.	2,000	2	2	0.5	0.45	0	Trace of albumen; occasional rbc and wbc; reducing substance.	
		2,000	3	2	0.5	1.18	2+		
		5,000	3	2	4.12	30.0	7+		
		10,000	3	2	4.17	30.0	7+		
(7) A. L.	" s.b.e.	20,000	2	2	22.5	14.1	0	Occasional rbc and wbc; reducing substance.	
		20,000	3	5	22.5	66.5	3		
(8) A. B.		10,000	2	2	40.3	37.5	0	Trace of albumen; rbc; reducing substance.	
		10,000	3	5	40.3	86.9	2+		
(9) F. L.	" *viridans*	10,000	3	8	18.0	90.5	5	Trace of albumen; occasional rbc and wbc; reducing substance.	Nausea

(*5, 11*). The caronamide was given orally in 2- or 3-gram dosages every 4 hours, day and night. To allow for adequate equilibration, the drug was administered at least 12 hours before blood samples were drawn for penicillin assay.[2] Following the coadministration of caronamide and penicillin, blood-level testing was done at various stages of the treatment period. For the most part, blood samples for penicillin assay were drawn an hour after the intake of a given dose of caronamide, when the influence of the compound is supposedly at its peak. The penicillin was given intravenously in the usual standard, the minimum increase over control levels was twofold, and the maximum increase was seven fold. The total daily intravenous dose of penicillin, which ranged from 1,000,000 to 20,000,000 Oxford units, apparently had no influence on the degree of augmentation following caronamide administration.

The side-effects observed in these 9 patients were transitory and insignificant. Beyer and his group have reported 3 instances of the occurrence of a rash following the administration of caronamide (*3*). No cutaneous manifestations were encountered in our patients.

A reducing substance was discovered in the urine in practically every patient receiving 3 grams of caronamide every 4 hours. This disappeared from the urine shortly after the drug was discontinued and is presumably a metabolite product of caronamide (*3*).

[1] The authors are indebted to the Medical Research Division, Sharp & Dohme, Inc., for the generous supplies of caronamide used in these studies.

[2] The penicillin assay method used was that of Rosenblatt, *et al.* (*15*), which employs *Str. pyogenes* C203 as test organism. In a comparative study this system was found by Dolkart, Dey, and Schwemlein (*4*) to yield generally and, at times, appreciably lower values than the F.D.A. assay procedure described by Randall, Price, and Welch (*13*), which uses *Bacillus subtilis* NRRL B-558 as the test organism.

[3] Supplied by Chas. Pfizer & Co., Inc.

It may be stated that there is now available an oral preparation which in suitable dosage consistently augments penicillin levels. The compound helps to conserve the consumption of penicillin where massive daily dosages are required, the economic implications of which are obvious. More important, some patients have difficulty in maintaining adequate blood levels despite intensive penicillin dosage. Ordinarily, following the administration of intravenous penicillin, it is not unreasonable to expect and obtain 0.1 Oxford unit/ml. of blood for every 100,000 units of penicillin administered (*12*, *14*). It is not always possible to maintain this ratio in a given patient. With the conjoint use of enhancing agents such as caronamide, not only can the expected blood values for a given intravenous dose of penicillin be obtained, but multiples of these anticipated values can, in point of fact, be achieved (Table 1, Case No. 6). This can mean the difference between success and failure in the treatment of the refractory case of subacute bacterial endocarditis.

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Experimental Determination of the Gyrofrequency

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The basic magneto-ionic theory of wave propagation in the ionosphere in the presence of the earth's magnetic field, as developed by Appleton (*1*) and by Appleton and Builder (*2*), was confirmed to an approximation in the lower latitudes some years ago. More recently extensive ionospheric observations in high latitudes have become available for the first time. Pronounced peculiarities in character of radio wave components returned at vertical incidence from the ionosphere in high latitudes have stimulated testing of the basic theory in terms of this new experimental information. For example, Scott and Davies (*4*) have described multiple magneto-ionic refraction of the wave energy into three or more components in a high geographic latitude. The three major components described by them indicate that both the longitudinal and transverse modes of wave propagation predicted by the theory occur simultaneously in certain high geomagnetic latitudes.

Through the courtesy of the College Geophysical Observatory, University of Alaska, some 800 selected ionospheric records from that station have been studied. In each record chosen it has been possible to determine independently the penetration frequency of wave components corresponding to: (a) the longitudinal ordinary ray, (b) the transverse ordinary ray, and (c) the extraordinary rays for both longitudinal and transverse modes of propagation. In addition, height of maximum electron density for the ionospheric layer under study has been determined.

The purpose of this note is to describe the experimental evidence, to review appropriate aspects of the magneto-ionic theory, and to discuss peculiarities disclosed in an attempt to reconcile theory and experiment.

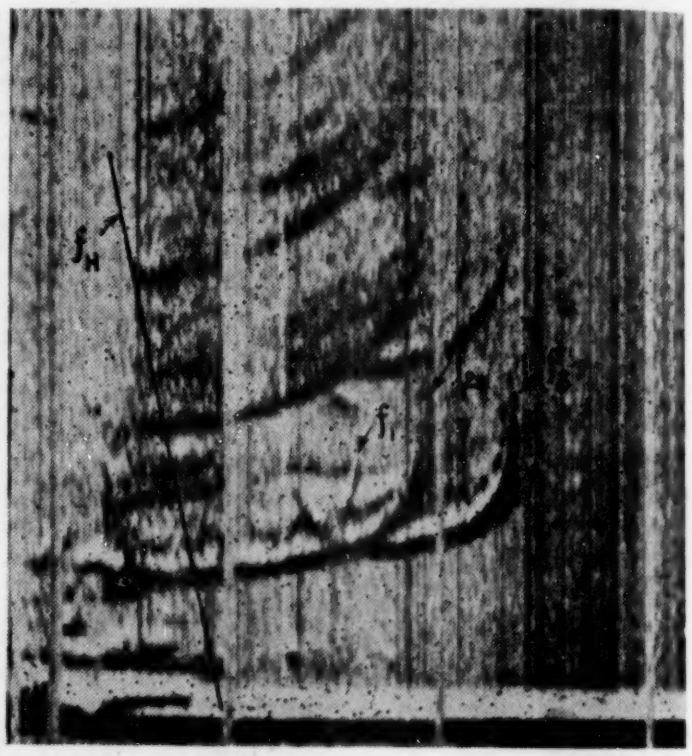

Fig. 1. Typical illustration of longitudinal and transverse modes of propagation occurring at the same time.

Consider Fig. 1, which is a typical ionospheric record taken at the University of Alaska. Ordinates are virtual height, increasing upward. Abscissas are wave frequency, increasing to the right. Penetration frequencies as noted in the figure are as follows: f_1, the longitudinal ordinary ray; f_2, the transverse ordinary ray; f_3, the extraordinary rays; and f_H, the calculated gyrofrequency for electrons in the earth's magnetic field. Experimentally, numerical values of f_1, f_2, and f_3 were determined from each record, as well as the height of maximum electron density, after the technique of Booker and Seaton (*3*).

The magneto ionic theory predicts, to a first approximation, that the relationship between wave components returned at vertical incidence from the ionosphere is as follows:

(a) For transverse mode of propagation—

$$(f_3 - f_2) = \frac{f_3 f_H}{(f_3 + f_2)} \qquad (1)$$

(b) For longitudinal mode of propagation—

$$(f_3 - f_1) = f_H \qquad (2)$$

The experimentally determined values were first examined in

terms of the change in precession-frequency with height for transverse mode of propagation in the sporadic E-layer. Fig. 2 gives precession-frequency as a function of height. Each

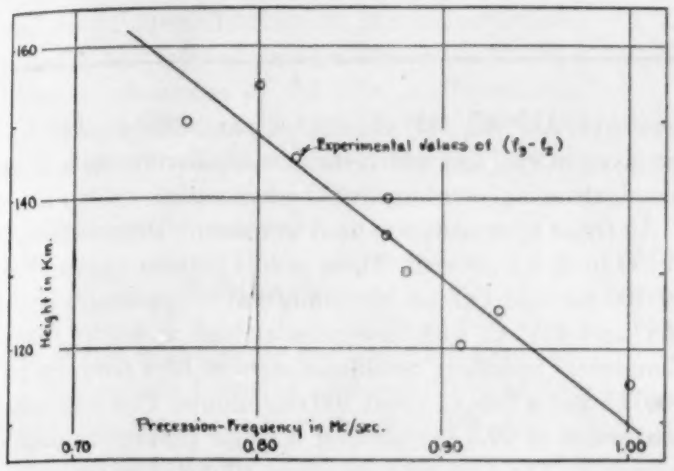

FIG. 2. Precession-frequency in the sporadic E-layer for transverse propagation, College, Alaska.

point of the diagram is the mean value of approximately 20 independent measurements. Clearly, the precession-frequency falls rapidly with increase in height, over the height range available experimentally.

Next, values of f_H were calculated for the transverse mode of propagation from experimental values of f_3 and f_2 for the

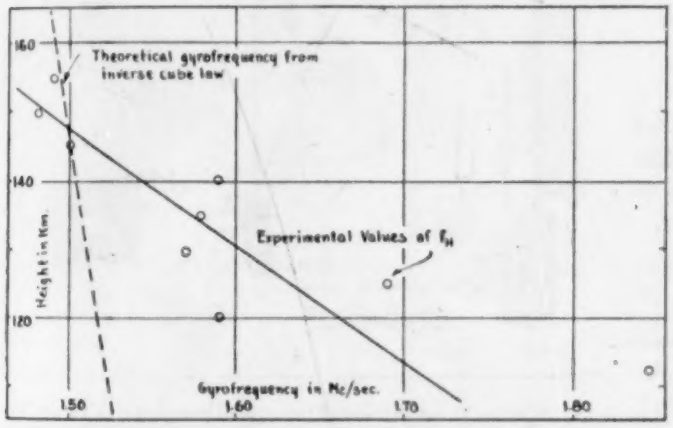

FIG. 3. Experimental values of gyrofrequency determined in the sporadic E-layer for transverse propagation, College, Alaska.

sporadic E-layer. In Fig. 3 these values of f_H are given as a function of height. The dotted line to the left in the figure is the theoretical value of gyrofrequency to be expected if the earth's magnetic field decreases inversely as the cube of the distance. Again, each point is the mean value of approximately 20 independent observations.

Evidently over the range of height involved the experimental values of gyrofrequency do not agree with theoretically expected values. That the slopes of the experimental and theoretical curves do not coincide is interesting. Since the magneticians have suggested that variations in the earth's magnetic field may be explained on the basis of a sheet of current flowing in a region of the atmosphere below a height of 100 km., the question may well be raised as to whether or not the observed departures of experimental from calculated values of f_H may be the result of induced magnetic field from such a current flow.

In order to examine the relationship between calculated and experimentally determined values of gyrofrequency over a more extended height range, Fig. 4 is presented. Each point in the diagram is the mean value of approximately 40 independent determinations. Generally speaking, the agreement between values of f_H determined by means of the longitudinal mode of propagation and those found theoretically is quite good except

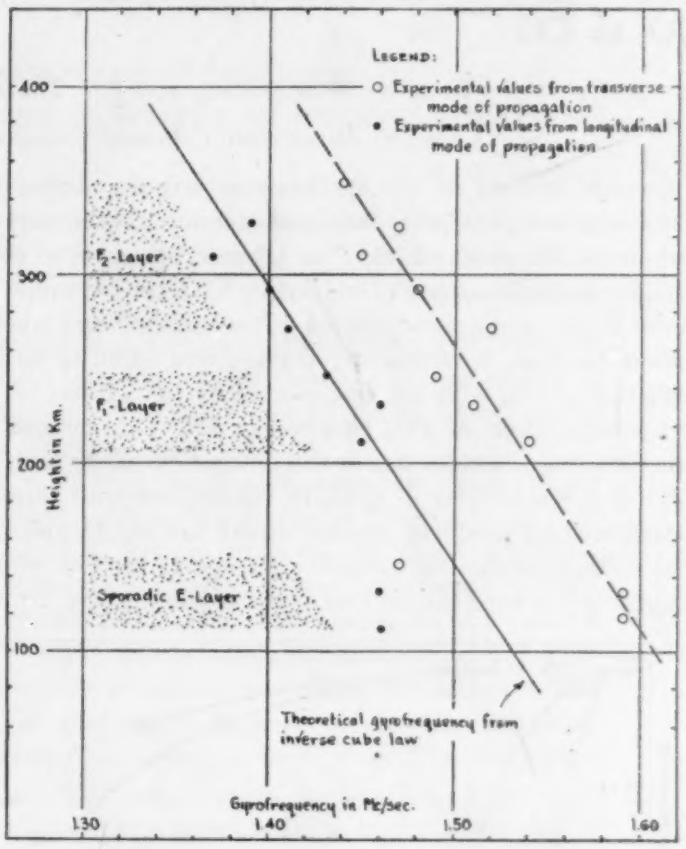

FIG. 4. Mean values of gyrofrequency determined experimentally at College, Alaska.

over the height range in the vicinity of the E-layer. Upon the basis of such agreement it can be said that the magneto-ionic theory for longitudinal mode of propagation is substantially confirmed.

However, the experimental values of f_H determined from the transverse mode of propagation lie consistently to higher values by about 0.08 Mc/second. While this difference is small, it appears to be real. Just why this constant difference exists between values of f_H determined experimentally from longitudinal and transverse modes of propagation is not clear. Perhaps the simplifications employed by Appleton and by Appleton and Builder in interpretation of the theory are responsible for this lack of correspondence. Some differential effect, possibly associated with the treatment of collisional friction, may be responsible for the discrepancy. Until an adequate explanation is decided upon it cannot be said that the magneto-ionic theory is in agreement with experimental results in high geomagnetic latitudes for the transverse mode of propagation.

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IN THE LABORATORY

Conversion of Isotopically Enriched CO_2 to CO

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Current interest in the synthesis of organic compounds containing isotopic tracer atoms makes it desirable to convert carbon dioxide enriched in C^{13} or C^{14} into other useful compounds. A simple method of converting C^*O_2 to C^*O would be useful in the synthesis of labeled methyl alcohol[1] and labeled sodium formate. A satisfactory method was found to be the reduction of CO_2 with hot zinc as used by the authors (*3*) in the concentration of CO_2 enriched in C^{13}. This method of concentrating C^{13} made use of the isotopic exchange reaction $C^{13}O + C^{12}O_2 \rightleftarrows C^{12}O + C^{13}O_2$ in conjunction with thermal diffusion which produced countercurrent flow of CO_2 and CO. The $C^{13}O_2$ produced by isotopic exchange at the hot wire is transported toward the bottom of the column, where it must

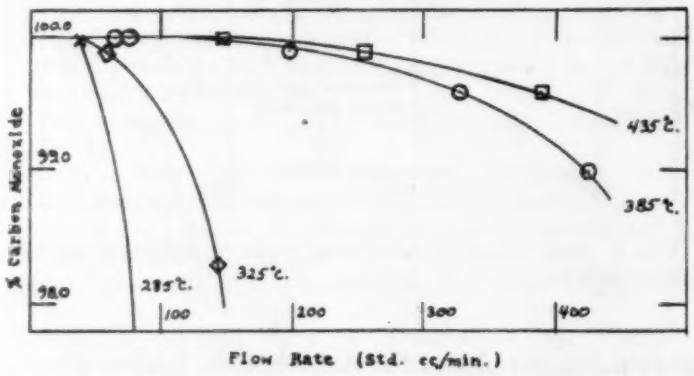

FIG. 1. Effect of flow rate and temperature on percentage conversion of CO_2 to CO.

be converted to $C^{13}O$ if total reflux is to be established. This conversion was accomplished by circulating the CO_2 through zinc powder at about 400° C. (*1*). It was found advantageous to support the zinc dust on asbestos fiber to give greater porosity and to prevent clogging. Small pellets about 6 mm. in diameter were made from a moistened mixture containing 95 per cent by weight zinc dust and 5 per cent asbestos fiber of the type used for Gooch crucibles. These were dried at 110° C. for 24 hours before being placed in the converter. Spectrographic examination of the zinc (technical grade) showed the presence of Pb, Cu, and Sn as impurities.

In order to study the efficiency of conversion of CO_2 to CO under various conditions, 50 grams of the zinc pellets were placed in a 15-cm. length of Pyrex tubing 25 mm. in diameter. A Chromel-Alumel thermocouple was attached to the outside wall, and the converter was then placed in a furnace. Carbon dioxide at atmosphere pressure was passed through the converter at several rates of flow at each of the following temperatures: 435° C., 385° C., 325° C., and 285° C. The result are given in Fig. 1, in which the percentage conversion at each temperature is plotted against the flow rates.

An Orsat apparatus was used to measure the concentration of CO to ± 0.2 per cent. These results indicate that a yield of 99–100 per cent CO can be obtained at temperatures between 385° and 435° C. with flow rates as high as 400 cc./minute. Convenient operating conditions seem to be a temperature of 400° C. and a flow of about 100 cc./minute. This will assure a conversion of 99.5 per cent for a single passage through the converter. The CO_2 may be forced through the converter by means of pressure or drawn through with a Toepler pump arrangement. About 15 l. was converted for use in the chemical exchange column without any loss in efficiency of the converter.

The available quantity of isotopically enriched CO_2 is frequently small; consequently, a method of converting smaller volumes of CO_2 is desirable. Suitable arrangements are

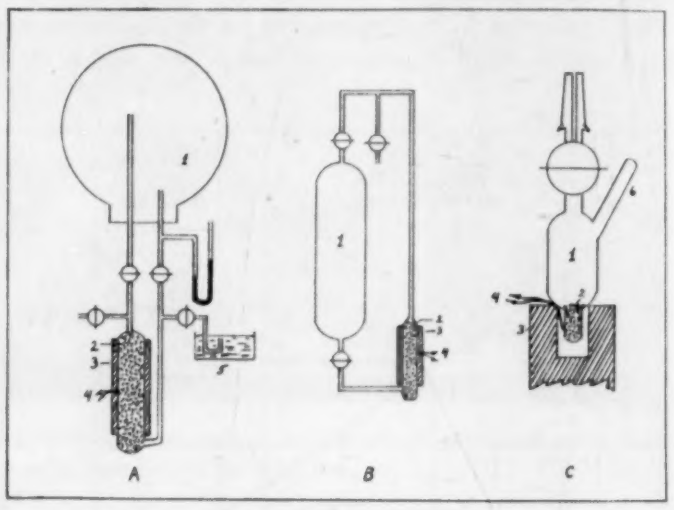

FIG. 2. Apparatus for conversion of isotopically enriched CO_2 to CO: (1) sample container; (2) zinc-asbestos mixture; (3) furnace; (4) thermocouple leads; (5) mercury trough for collecting samples; (6) inlet for introducing zinc-asbestos mixture.

illustrated in Fig. 2 (B, C) for use with conventional-type sample tubes. The apparatus shown in Fig. 2(A) was used to measure the efficiency of the converter when connected to a closed system in which the samples are frequently stored. The converter was attached in a vertical position to the two glass tubes leading into the 2-l. bulb which contained CO_2 at a pressure of about 80 cm. Hg.

After evacuating the converter, the furnace was adjusted to the desired temperature and the stopcocks opened. Convection up through the converter acts to recirculate the gas from the bulb through the zinc pellets. Small samples (0.5 cc.) were withdrawn periodically and analyzed with a Blacet-Leighton microgas analysis apparatus (A. H. Thomas Company). Experiments at 425° and 480° C. (Fig. 3) showed that practically complete conversion was obtained in 5–6 hours. The fact that no significant change in total pressure occurred indicates that very little, if any, CO is lost by decomposition.

[1] See, for example, the high-pressure synthesis of deuteromethyl alcohol from CO and D_2 by J. E. Zanetti (du Vigneaud, V., Chandler, J. P., Cohn, M., and Brown, G. B. *J. biol. Chem.*, 1940, **134**, 787).

solid curves represent the dependence of CO concen- on the time as obtained from the results of the following tions. If x is the mole fraction of CO in a bulb (of V cc.) at a time t, then with a convective transport T cc./minute upwards through the converter, the CO_2 into the converter at time t is T(1−x) cc./minute. ing complete conversion of the CO_2 in the mixture T(1−x) also represents the increment in the flow of CO the top of the converter at time t. The net increase number of cubic centimeters of CO in the vessel is then by:

$$V\frac{dx}{dt} = T(1-x).$$

solution of this equation for the boundary condition, 0 at t = 0, gives the following expression for the time dence of the concentration of CO in the vessel:

$$x = 1-e^{-Tt/V}.$$

two solid curves in Fig. 3 were obtained by substituting ctive flow rates of T = 35 cc./minute and T = 40 cc./ te in the above equation. It is therefore evident that the ctive flow in the converter was approximately 35–40 inute. Using this value for T, the percentage con- n at any time, t, can be calculated. It can be seen that

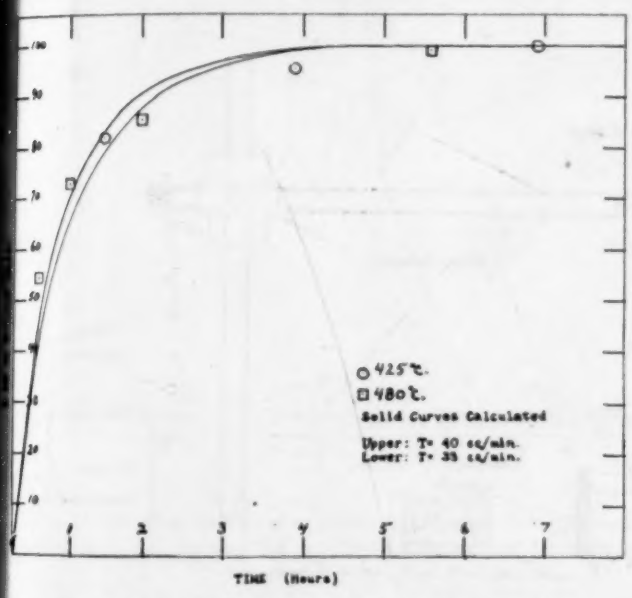

FIG. 3. Rate of conversion of CO_2 to CO in a closed system.

method may readily be adapted to the determination of ective transports through different types of packed mns for engineering experiments.

o test the method for conversion of small samples, a 5-cc. tion vessel containing about 1 gram of the powdered asbestos mixture, as illustrated in Fig. 2(C), was used in ection with a standard system (*2*) for obtaining CO_2 $BaCO_3$. Carbon dioxide was liberated from 40 mg. of CO_3,[2] in which a mass spectrographic analysis showed 3 per of the carbon atoms to be C^{13}. After the sample was sferred to the reaction vessel, the zinc was heated to about C. for two hours. Analysis with the microgas analysis aratus showed 99 per cent conversion to CO. Mass spectro- hic analysis showed that it contained 3 per cent $C^{13}O$.[3]

The authors are indebted to Dr. A. V. Grosse of the Houdry Process oration for the barium carbonate enriched in C^{13}.

Thanks are due to E. H. Mosbach for assistance with the mass spectro- ic and gas analyses and to Miss M. Lamson for help with the spectro- ic analyses.

The carbon monoxide may be converted back to carbon dioxide, if desired, by passing it through copper oxide heated to 400° C.

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A Kinesimeter for Studying the Spontaneous Activity of Small Animals

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With the increase in number of sympathomimetic amines in use and under investigation for their circulatory effects, it has become necessary to study their effects on central stimulation with ever-increasing accuracy.

Many types of activity recorders have been employed for this purpose and with varying degrees of results.

As early as 1898, Stewert (*6*) tested the effects of alcohol, diet, and changes in barometric pressure on the spontaneous activity of small animals. His method consisted of a squirrel cage made of wire mesh 18 inches in diameter and 20 inches in length. The animal's movements caused the cage to rotate. An eccentric coupled to the escapement mechanism of an alarm clock caused the revolutions to be registered by the second hand. Slonaker (*5*), using a slight modification of the same technique, studied the normal activity of the white rat at different ages. His findings showed that the greatest activity of the rat occurred when the animal was 87–120 days old.

The above method, of course, is suitable only for the type of research in which activity is studied for many days or weeks. For studies of activity due to the central nervous excitability of various drugs, involving only a few hours, a much more sensitive apparatus had to be developed.

Schulte, *et al.* (*4*) used a cage and spring suspension, coupled to a work adder by a string. As the animal's motions moved the cage, the work adder revolved. A signal magnet recorded these motions on a kymograph. This method has a decided advantage in that it takes into account both large and small motions and accumulates them. However, the cage is undamped and is free to oscillate in any direction.[1]

Abreu (*1*) used a cage suspended by a spring in which the movements were transmitted by a tambour-air system to a kymograph.

The above types of apparatus are best described by the term "jiggle" cages. Since they are all suspended on coiled springs, one movement of the animal results in from one to several movements of the cage. Both vertical and pendular movements may be transmitted to the recording devices.

[1] C. W. Geiter, of Frederick Stearns & Company, developed a method whereby a cage was suspended on a spring. As the animal's motions caused the cage to move up and down, a flag cut a beam of light, causing a photocell to operate a counter (unpublished).

Ross E. Hart, of Jefferson Medical School, Philadelphia, studied activity by means of transmitting the motions of an activity cage coupled to an air tambour writing on a kymograph. By this method activity can be judged roughly by inspection of the records (unpublished).

These types of apparatus serve very well for screening work, but for more accurate work a type in which the spring is damped sufficiently to eliminate the "jiggle" is required. It is also desirable to eliminate any pendular movements which might record.

The apparatus herein described (Fig. 1) consists of a Lucite cage. The advantages of Lucite are its lightness in weight and its rigidity, which imparts the full force of the animal's motions to the upper electrode. The closed bottom of the cage resting upon a sheet of metal which forms another electrode. By this means a variable resistance is formed is connected in series with a series wound fractional power motor. A speed reducer of variable ratio at the the motor drives a revolution counter. This assembly ported by a ½-inch coiled spring, the tension of which varied according to the weight of the rat.

The upper electrode is so mounted that its height adjusted independently of the rest of the apparatus

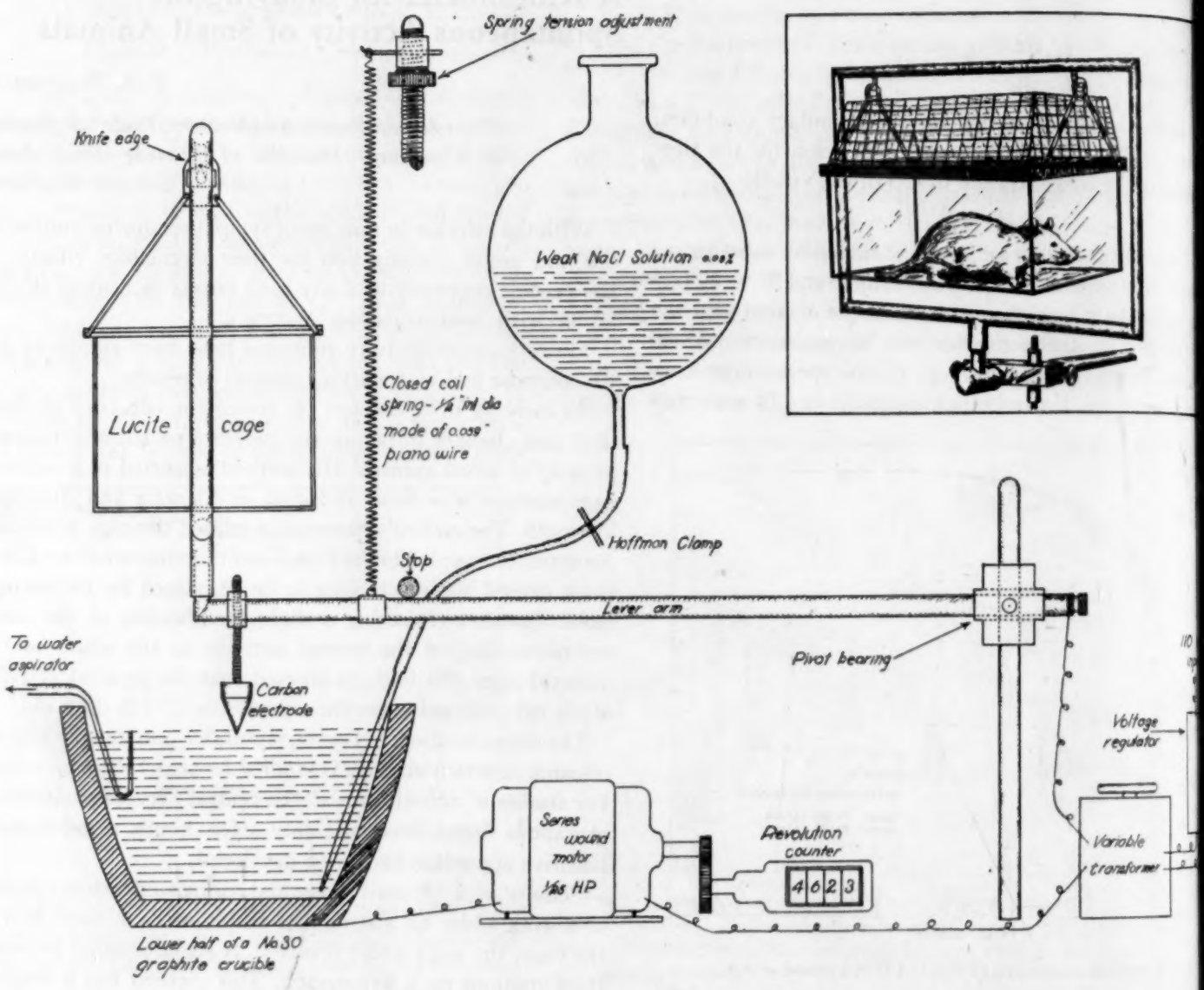

FIG. 1. Semidiagrammatic drawing of kinesimeter. Cage suspension is shown in insert.

keeps the animal's urine from getting into the electrolyte solution. The lid is made of ¼-inch mesh screen wire in the form of an inverted box, so that the animal's movements are completely unhampered. The cage is suspended on knife edges mounted rigidly to one end of a horizontal brass tube 20 inches long. The other end of this tube is attached to an upright by pivot bearings. It is very important that the cage be suspended on knife edges, since direct attachment of the cage to the horizontal lever arm changes the arm's length as the rat shifts its position from side to side. If the rat went to sleep on the side of the cage distal to the pivot of the horizontal arm, the motor would turn and thus faultily register activity. The whole assembly is suspended on a damped coiled spring. Directly under the plastic cage is mounted a pointed carbon electrode. This upper electrode dips into a weak solution of sodium chloride (.08 per cent) contained in a No. 30 graphite crucible regulated that it barely makes contact with the salt The current is decreased by a variable transformer or rh until the motor armature just ceases turning. This caus motor as well as the spring to be heavily damped.

The slightest movement of the animal which results downward thrust will push the pointed (upper) elec downward in the salt water, which in turn decreases resis in the circuit and causes the motor armature to turn. D the conical shape of the electrode, the further it is thrust the salt water, the faster the motor will revolve. Sinc spring supporting the apparatus follows Hooke's law, the of the electrodes can be adjusted to cancel, or at least mini the effect of the spring. Thus, the counter registers onl downward thrust of the rat.

The instrument can easily be made self-recording. The lution counter is removed, and the speed reducer sh

extended several inches. At the end of the shaft is mounted a 2-inch writing point which describes arcs on a slowly moving kymograph. A 15-minute-interval time signal is included with the assembly.

In our studies only male white rats were used, thus eliminating any behavior which might be due to various phases of the oestrus cycle of the female. The animal is first placed in the cage, and the apparatus is adjusted to its weight. It is then removed and injected with the solution under investigation. Twenty-eight animals injected with normal saline were used as controls. The amount of saline injected was made to correspond with the volume of the drug injected. As soon as the injected animal was placed in the cage the initial reading was

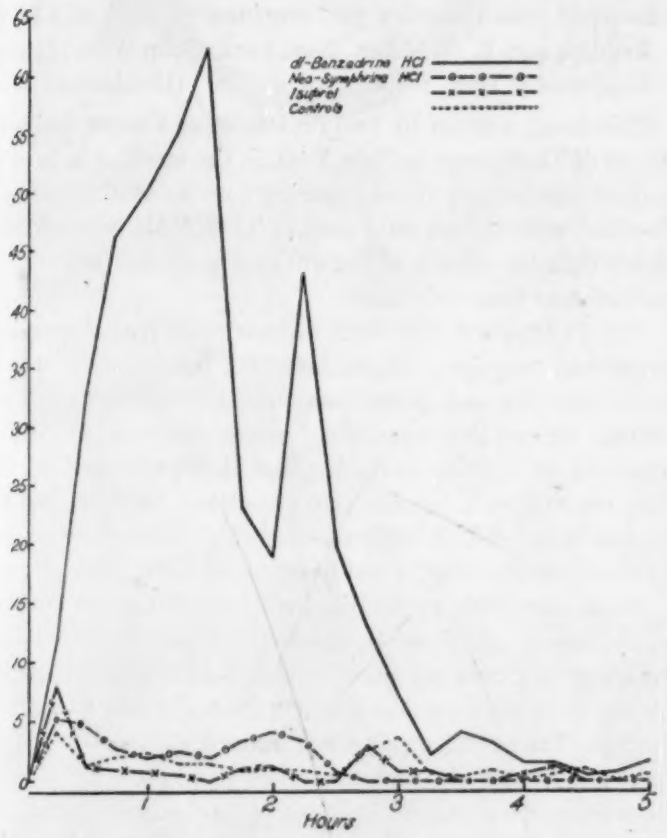

FIG. 2. The effect of dl-benzedrine hydrochloride, Neosynephrine hydrochloride, and Isuprel upon the spontaneous activity of albino rats

taken. Subsequent readings were taken at 15-minute intervals the increments between readings being recorded and plotted on graph paper.

The number of rats and the dosage used in the case of each compound tested were as follows:

	No. of rats	Dosage (mg./kg.)
dl-Benzedrine HCl	6	5.0
Neosynephrine HCl	6	1.75
1(3′,4′-Dihydroxyphenyl)-2-isopropylamino-ethanol HCl (Isuprel)	6	1.0
N-Methyl-β-cyclohexylisopropylamine HCl		
d-isomer	9	20.0
d-isomer	12	5.0
l-isomer	15	5.0

The results of the tests with the first three compounds, (Fig. 2) which are in agreement with other workers in the field, clearly show that dl-benzedrine hydrochloride is extremely exciting to the central nervous system, whereas Neosynephrine hydrochloride and Isuprel show no appreciable stimulating properties.

Both of the two other compounds studied, l-N-methyl-β-cyclohexylisopropylamine hydrochloride and d-N-methyl-β-cyclohexylisopropylamine hydrochloride, showed only a small amount of stimulation of the central nervous system. The d-isomer exhibited about twice the stimulating effect of the l-isomer. This is not in agreement with the results obtained by Frick and Becker, as reported by Lands, *et al.* (*3*). These investigators found the l-isomer somewhat more stimulating than the d-isomer. However, the writer's findings are in substantial agreement with that of Fellows and his workers, whose preliminary results show that 5 mg./kg. of the l-isomer induces less activity than 20 mg./kg. of the d-isomer (*2*).

Since the two isomers had not been given in comparable doses, it was thought advisable to do so. Accordingly, attempts were made to inject 20 mg./kg. of the l-isomer. The animals

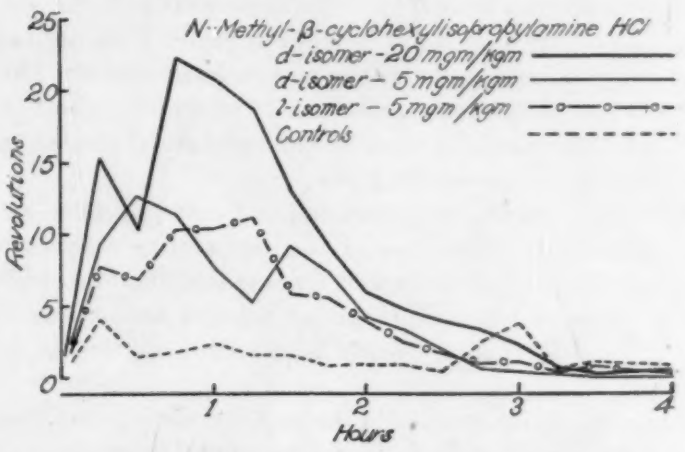

FIG. 3. The effect of d- and l-isomers of N-methyl-β-cyclohexylisopropylamine hydrochloride on the spontaneous activity of albino rats.

showed evidence of toxicity, and no activity resulted. The d-isomer was then injected at a dose level of 5 mg./kg., and the animals responded immediately with increased activity. These results are shown in Fig. 3.

The theoretically ideal kinesimeter would be one which records the motions of an animal directly and does not depend upon any moving parts for its operation. Thus, errors caused by pendular movements and "jiggle" of the machine would be eliminated. This recorder should be extremely sensitive to all movements of the animal's body, including small motions of the head. The apparatus, in addition, should integrate these small movements with large body movements. It would also be desirable if the machine would record in absolute units such as gram-centimeters of work per unit of time, instead of revolutions of a wheel, the pumping of a quantity of water, or the turning of a motor armature.

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Book Reviews

Low-pressure laminating of plastics. J. S. Hicks. New York: Reinhold, 1947. Pp. 162. (Illustrated.) $4.50.

In the words of the author, "The very young field of low-pressure laminating and fabricating has set forth in its swaddling clothes after V-J Day to seek its proper place. . . ." The technical usefulness of these relatively new resins and processes is a challenge to plastic fabricators. This book, therefore, should be very helpful to those who want to become acquainted with this field. The low-pressure laminating techniques are explained in very elementary fashion with many pictures to illustrate the various steps.

The author has limited his discussions strictly to the low-pressure techniques and has carefully refrained from padding the book with information on the many related subjects. Lists of books and pertinent references can be found throughout the text; also, the names of some of the suppliers of laminating equipment and materials are given.

The final chapter on engineering and cost principles contains interesting tables showing the comparative weight and cost per cubic foot of the various types of structural materials, and a list of 11 experiments, giving detailed instructions for making and fabricating simple laminations, appears in the appendix.

Although the information in the book is reliable and instructive, it is designed primarily for the beginner. The expert might find it disappointing for that reason.

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Concise anatomy. Linden F. Edwards. Philadelphia: Blakiston, 1947. Pp. xxiv + 548. (Illustrated.)

This book represents the second edition of a text first published in 1934 under the title *Anatomy for physical education.* The present edition has been written for the student in the various ancillary fields of anatomy, such as physical therapy, nursing, etc., and is not intended as a substitute for the more comprehensive treatises used by medical and dental students. Regional anatomy is emphasized rather than systemic, although several chapters are devoted to the major systems. The text is, on the whole, clear and well written. The illustrations are adequate, but few are original; 225 of the 324 total are taken from Morris' *Human anatomy* alone. The physical aspect of the book and the arrangement of the printed page is clear and pleasing.

Evaluation of the over-all worth of a new textbook of anatomy is difficult. So many have been written, and for so many purposes. Errors or differences in interpretation can be found in all of them, the large as well as the small. The basic material is comparatively well standardized, and the chief discrepancy of opinion invariably lies in the amount of descriptive detail deemed necessary for the purpose. A certain class in physical therapy once taught by the reviewer would have been swamped by the detail in *Concise anatomy*; in the hands of Prof. Edwards they might have thrived upon it. The average medical student, in these turbulent days of "down with nonessentials," would be apotheosized if he knew half of Prof. Edwards' book, but no professor of anatomy will ever be willing to admit this. These are the facts and individual opinion remains largely just that.

JEAN PIATT

University of Pennsylvania

Advanced mathematics for engineers. (2nd ed.) H. W. Reddick and F. H. Miller. New York: John Wiley; London: Chapman & Hall, 194. Pp. xii + 5087. (Illustrated.) $5.00.

This book, written by two professors at Cooper Union Institute of Technology in New York, is the result of lectures for juniors and seniors in engineering courses at this Institute. The first edition was published in 1938. This second edition shows that the efforts of the authors have met with the appreciation of their colleagues.

The 11 chapters deal with ordinary differential equations, hyperbolic functions, elliptic integrals, infinite series, Fourier series, Gamma and Bessel functions, partial derivatives and partial differential equations, vector analysis, probability, functions of complex variables, and the operational calculus. This constitutes a considerable amount of material, and it is treated very well. A large number of problems, the answers to which are given in the last pages of the book, enrich the text.

Some interesting applications enliven the theory. Examples of the use of hyperbolic functions are Schiele's pivot and the buckling of a rotating shaft; elliptic functions are illustrated by the skipping rope and the field intensity due to a circular current. The problem of a wire clamped at its lower end at a small angle with the vertical serves as a case which leads to Bessel functions. As applications of partial differential equations of the second order we meet the determination of the resultant magnetic field strength arising from a current excited in a solenoid and the induced eddy currents set up in the copper core, as well as a problem of the drying of a porous slab by evaporation. The chapter on the operational calculus includes not only the Heaviside operators, but also Bromwich' line integrals.

The second edition differs from the first mainly by an appendix of 5 pages on "Units and Dimensional Analysis," a considerable extension of the number of problems, and the addition of a few new topics. The authors mention specifically among these new problems a mechanical brake problem involving elliptic integrals (based on an article by I. Opatowksi, *Amer. math. Monthly*, 1941, p. 443), a more extended treatment of Fourier series, and an article on the vibrating membrane in a rigid rectangular frame.

This reviewer is very well pleased with the authors' clear way of exposition; it is a pleasure to read this book. It can be strongly recommended to students of engineering and physics who are in need of advanced calculus either as their main text or as supplementary reading. It ranks with the best books on this subject in any language.

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